User manual

of hot water pellet boiler of series

„MARIO”

and

automatic pellet burner of series

“ERATO GP20+”

http://www.erato.bg

Producer	ERATO Product Ltd
Address	Bulgaria, Haskovo 6300, blv.“Saedinenie” 67
Telephone	+359 38 603050 , +359 38 603052
Fax	+359 38 603054
e-mail	product@erato.bg
home page	http://www.erato.bg/product/

Thank You for buying the system, consisting of : hot water pellet boiler of series „MARIO” and a pellet burner of series “ERATO GP20+”. This manual will help You to use and maintain the units properly.

This document is intended to be used as additional information for the service team, which will install and adjust the system, as well as maintenance information, which will help the end user.

The producer requires the service staff, which will perform the above mentioned procedures, to get training course at the producer’s training center and get certified as well.

ATTENTION!

- *In interest of your personal security it is obligatory to read thoroughly and carefully this instruction manual before proceeding with any actions with the system – mounting, connecting, etc. its elements. In case that requirements, depicted in this manual are not satisfied, failures of any element of the system could be expected, or even fatal consequences, for which the system’s producer does not take responsibility;*
- *In interest of your personal security it is obligatory to read thoroughly and carefully instruction manual of the pellet burner of series “ERATO GP20+” before proceeding with any actions with the burner – mounting, connecting, etc.. In case that requirements, depicted in its manual are not satisfied, failures of the pellet burner could be expected, or even fatal consequences, for which the burner’s producer does not take responsibility;*

CONTENTS

p.

1. Main properties and advantages of the system, consisting of: hot water pellet boiler of series "MARIO" and pellet burner of series "ERATO GP20+". 6
2. Description of the system: hot water pellet boiler of series "MARIO" and automatic pellet burner of series "ERATO GP20+". 8
2.1. Description of the heat exchanger of hot water pellet boiler of series "MARIO" 8
2.2. Description of the pellet burner of series "ERATO GP20+" 10
3. Technical data for the system, consisting of: hot water pellet boiler of series "MARIO" and a pellet burner of series "ERATO GP20+". 15
4. Installation process of the system 23
4.1. Special features and requirements for assembly and installation of automatic pellet burner of series "ERATO GP20+" and hot water pellet boiler of series "MARIO" 23
4.2. Requirements for installation of system : hot water pellet boiler of series "MARIO" and pellet burner of series "ERATO GP20+": 23
4.3. Installation and attachment of the modules of the system : hot water pellet boiler of series "MARIO" and automatic pellet burner of series "ERATO GP20+" 24
4.3.1. Basic requirements for installation of hot water pellet boiler of series "MARIO" : 24
4.3.2. Installation of the system 25
4.3.3. Installation of the hot water pellet boiler of series "MARIO", considering it's easy maintenance and servicing : 25
4.3.4. Boiler's positioning according to the requirements for attachment to the electric power supply circuit 26
4.4. Procedure for installation of the modules of the system 26
4.4.1. Connecting to the chimney 26
4.4.2. Connecting to the heating system 26
4.4.3. Installation of the automatic pellet burner of series "ERATO GP20+" 27
4.4.4. Installation of the two ceramic plates in the combustion chamber of the boiler 28

4.4.5. Install the secondary ash lid at the bottom of the convective part of the boiler; 29

4.4.6. Installation of the flue gases duct lid 29

4.4.7. Installation/verification of the horizontal combustion lids and the combustion chamber cover..... 31

4.4.8. Install the heat exchanger's convective duct lid 31

4.4.9. Install the boiler's heat exchanger combustion chamber lid..... 32

4.4.10. Connect the pellet burner of series "ERATO GP20+" to the hot water boiler of series "MARIO" 33

4.4.11. Installation of the pellet transport auger 34

4.4.12. Pellet transport auger fuel charging. 34

4.4.13. Connect the control box of the boiler to the power supply;..... 34

4.4.14. Final view of the system 35

4.4.15. Recommended principal hydraulic scheme for the hot water pellet boiler 36

5. System starting procedures. 38

5.1. Basic fuel requirements. 38

5.2. Starting up the system (consisting of hot water pellet boiler of series "MARIO" and automatic pellet burner of series „ERATO GP20+"). 39

5.2.1. Interface control board of hot water pellet boiler of series "MARIO" 40

5.2.2. Hot water boiler of series "MARIO" power supply. 41

5.2.3. System very first start 41

5.2.4. Operating parameters of the boiler. 42

5.2.5. Operating parameters for adjustment of the pellet burner of series "ERATO GP20+" 42

5.2.6. Nominal operating mode of the system. 44

5.3. Control of the thermal capacity of the system. 44

5.3.1. Decreasing the thermal capacity of the system: 45

5.3.2. Increasing the thermal capacity of the system: 45

5.4. Adjustment of the combustion process. 45

5.5. Stopping the operation of the system. 45

5.6. Turning OFF the system. 46

- **Emergency stop of the system.** 46

5.7. Showing and teaching the end user about the maintenance and adjustment procedures. 47

5.8. Safety and unexpected risks 49

5.9. Operation faults and their repairing 50

5.10. Pellet system warranty form completion. 54

5.11. Actions, after the modules of the system are not in exploitation anymore. 54

6. Electrical scheme of hot water pellet boiler of series "MARIO". 56

QUALITY CERTIFICATE 57

WARRANTY CONDITIONS 58

WARRANTY SERVICE PROCEDURES LIST 60

1. Main properties and advantages of the system, consisting of: hot water pellet boiler of series “MARIO” and pellet burner of series “ERATO GP20+”.

The hot water pellet boiler of series “MARIO” is steel-plate hot water pellet boiler, which uses solid biomass fuel in shape of pellets. The boiler is designed to be connected to local hot-water heating systems, as well as heating up domestic hot water. The boiler uses wood pellets, as well as other type/shape of biomass, described in the user manual of the pellet burner of series “ERATO GP20+”, the resulting heat energy from thermo-chemical conversion (i.e. combustion process) is transmitted to the circulation water in its water jacket and the heat energy is transported to the heating system/consumer.

The system of the hot water pellet boiler of series “MARIO” includes:

- *hot water boiler – 1 sp.;*
- *automatic pellet burner of series “ERATO GP20+” – 1 sp.;*
- *ash tray – 1 sp.;*
- *bottom cap (for the cleaning section between the secondary and tertiary flue gases duct) – 1 sp.;*
- *ceramic elements – 2 sp.;*
- *flap – 1 sp.;*
- *door holder – 1 sp.;*
- *cleaning set (rake – 1 sp., hook – 1 sp.);*
- *electrical connectors – for room thermostat – 1 sp., for flue gas fan – 1 sp. ;*
- *power supply cable – 1 sp.;*
- *nut and washer M10 – 2 sp.;*
- *instruction manual – 1 sp.;*

The automatic pellet burner of series “ERATO GP20+”, which is an element of the system, could utilize following types of fuel:

- Wood pellets, having diameter 6 - 8 mm, categorized in the range of: A, AB, B (*according to the methodology, developed for pellets properties estimation in ERATO company*) or class ENplus-A1, according to EN 14961-2:2010;
- Pre-dried nuts (cherries for example);
- Fuel mixture – pellets and nuts (for example mixture ratio could be 50% - 50%);

- Other solid biomass based pellets, but confirmation for these fuels utilization need testing and approval by ERATO company laboratory;

The system consists of :

- Hot water pellet boiler of series "MARIO" – a steel plate heat exchanger, equipped with control board;
- Automatic pellet burner of series "ERATO GP20+";

System advantages

- The system is designed to utilize solid biomass fuel, making it environmentally friendly, CO_2 neutral and does not contribute to the global warming process – result of fossil fuel utilization;
- The specific price of the heat energy, delivered by solid biomass utilization is less dependent on the world fuel market trends and practically the heat energy price is competitive to the conventional energy sources;
- The system, consisting of : pellet boiler of series "MARIO" and a pellet burner of series "ERATO GP20+" is automatic and the thermal comfort achieved is close to that, originating from exploitation of fully automatic boilers, (for example liquid or gas fuel, as well as electric boiler), which makes it applicable in heating systems, equipped with programmable room thermostat;
- Automatic operation of the system, easy adjustment of the thermal capacity of the burner (utilizing the burner's potentiometer), the operation of the system could be controlled by programmable room thermostat, thus achieving high levels of thermal comfort and fuel consumption economy;
- The burner utilizes solid biomass fuel, in shape of pellets (wood pellets), dried nuts (cherry nuts for example) – for additional information see the burner's user manual;
- High efficiency;
- Low pollutant contents in the flue gases;
- Compact design, allowing simplified installation procedure and easy maintenance (at servicing as well as ash deposits cleaning);
- The system could be utilized to heat-up domestic hot water;
- Simplified maintenance and service procedures;
- Minimized running costs;

2. Description of the system: hot water pellet boiler of series “MARIO” and automatic pellet burner of series “ERATO GP20+”.

The system consists of :

- **Hot water pellet boiler** of series “MARIO”;
- **Automatic pellet burner** of series “ERATO GP20+”;

2.1. Description of the heat exchanger of hot water pellet boiler of series “MARIO”

The hot water pellet boiler is steel plate welded construction, which is applied as heating unit for domestic heating systems which could be realized as driven by natural convection of the circulating water or systems, equipped with circulating pump. The hot water boiler is a module of the automatic heating system, designed for automatic wood pellets utilization and domestic hot water heating. The ash deposits cleaning is performed by special tool – grating the ash off the heat exchanging surfaces, collecting the mineral mass and other residues in the ahs container and waste depositing it into specially designed ash container. The combustion process, realized by the pellet burner, along with the combustion chamber of the hot water boiler, is optimized and sustains the high efficiency of the system. However, the overall performance of the system: hot water pellet boiler of series “MARIO” and the pellet burner of series “ERATO GP20+” depends on the chimney’s draught. In principal, the draught of the chimney depends on its condition , i.e. its height, as well its temperature and ash deposition, (other factors, which influence the draught).

The heat exchanger of the hot water pellet boiler of series “MARIO” complies with the acting requirements for such kind of units, defined in operating norm : *EN 303-5/2000 – „Heating boilers for solid fuels, hand and automatically fired, nominal heat output up to 300 kW. Terminology, requirements, testing and marking”*.

Figure 2.1. Front view of the hot water pellet burner of series "MARIO".

The hot water boiler consists of the following elements/modules:

- The main part of the hot water boiler is **the heat exchanger**, which has side orifice for pellet burner installation. The heat exchanger is produced in two versions – "**left sided**" – the pellet burner will be installed on its left side (looking in front of the boiler) and "**right sided**" – the burner will be installed in the orifice of the heat exchanger, made in its right side (again looking in front of the boiler);
- The **heat exchanger** is steel plate welded construction. In the front section of the heat exchanger is formed a combustion chamber and underneath is positioned the ash container. The heat exchanger is relatively compact construction and is designed as so called "three way heat exchanger" – the flue gasses duct is realized as three passes one. This design allows intensive heat exchange ratio and relatively small overall dimensions of the system;
- **Ceramic elements,** installed in the combustion chamber, which provide optimal conditions for the combustion process and efficient fuel utilization;

- **Ash tray** is positioned on the bottom of the combustion chamber. It collects the ash residue and allows easy de-ashing of the boiler's heat exchanging surfaces;
- **Inlet and outlet orifices** of the inflow and outflow circulating water, positioned on the back side of the boiler and are connections with female (internal) thread of size G1½", though which the boiler is connected with the heating system;
- **Drainage orifice** is an connection with female (internal) thread of size G½", which should be equipped with drainage valve;
- **Flue gas orifice** is positioned in the upper part of the back side of the boiler, the chimney should be connected to that flue pipe;
- **Steel plate heat exchanger**, its lid and doors are insulated with mineral wood, which ensures low heat loses rates to the surroundings;
- **Control board,** equipped with **operating thermostat**, controlling the operating mode of the pellet burner, **alarm thermostat**, which protects the boiler of overheating, **thermo-manometer gauge**, central "POWER" switch and a "START " switch;
- **External decorative plates,** produced from carbon steel, color painted;

2.2.Description of the pellet burner of series "ERATO GP20+"

The automatic pellet burner of series "ERATO GP20+" is mounted horizontally on either on the boilers of series "MARIO" left or right side, the burner is a separate and independent module of the system.

The pellet burner of series "ERATO GP20+" is separate module, which could be installed on already existing hot boilers and thus to perform fuel switch, i.e. to change the energy source from fossil fuel (like coal, wood logs, LPG, etc) to biomass based densified fuel – wood pellets, making the boiler's operation automatic.

The wood pellets allow easy automation of the combustion process as well as high efficiency at energy utilization. The wood pellets are solid biomass fuel and as they are utilized, solid residue – mineral ash will remain in the combustion chamber as well as on any other flue gas duct surfaces. However, the quantity of the ash residue is less that the ash of any solid fuel, due to the low ash content of the fuel. The specific price of the heat energy, produced at wood pellets utilization is concurrent, compared to the price of the energy, achieved from any other fuels and energy sources. The process performance of

the automatic pellet burner of series “ERATO GP20+” corresponds to the process control, performed by any automatic burner, utilizing fossil fuel (for example : gas, oil, heavy oil, etc). The operation process includes : automatic start-up and ignition, nominal operation and control of the high efficient combustion process are controlled by the control board of the burner. These properties of the burner allow to achieve high levels of thermal comfort, which is known from the popular fossil fuel based burners, but the fuel is biomass based product, with its advantages – attractive price and ecologically oriented.

- **Description of the construction of automatic pellet burner of series “ERATO GP20+”**

The automatic pellet burner of series “ERATO GP20+” is compact, module based construction, consisting of the following elements/modules:

- The basis part of the pellet burner is the **main unit**, which consists of:
    - **Combustion chamber,** which forms combustion domain and optimal environment for solid biomass combustion, is designed of high quality stainless steel;
    - **Grate of the combustion chamber,** which could be easily detached and reveals access for ash removal;
    - **Air duct**, which uniformly distributes the airflow and ensures safe cooling of the elements of the burner;
    - **Electric heater**, which heats and ignites the fuel. The heater is positioned beneath the inclined plate of the grate in the combustion chamber;
    - **Air supply fan,** equipped with Hall sensor for rotation speed monitoring;
    - **Photosensor,** which monitors the intensity/presence of the combustion process, installed aside of the combustion chamber for easy access and cleaning;
    - **Alarm thermo-probe,** which stops and blocks burner operation in case of “back fire” process in the fuel delivery pipe;
    - **Control board,** which monitors and controls the operation of the burner and indicates its status;
    - **Transport auger connector**, which realizes power supply to the electric motor of the auger;
    - **Interface panel,** which is equipped with light indicators and thermal capacity control gauge**;**

- **Transparent window,** though which the operation of the control board could be checked without removing the cover and any interventions;

- Electrically driven (external for the main unit) **fuel transport auger,** which extracts the solid fuel from the bunker and delivers pellets to the main unit, according to the operating mode of the burner. The transport auger consists of electric gear-motor, a transport pipe with one end in the fuel hopper and the other end is side opened and delivers fuel to the main unit though a aperture;
- **Flexible hose**, which is made of specific semitransparent thermal resistant material (in case of combustion process it does not emit toxic substances and does not sustain combustion process), which connects the transport auger and the main module;

COMMENTS : *Actual and detailed information for the technical information of the automatic pellet burner of series "ERATO GP20+" is described in its user manual*;

Figure 2.2. External isometric view of automatic pellet burner of series „ERATO GP20+".

The main modules of the pellet burner and their arrangement are shown of the following figure.

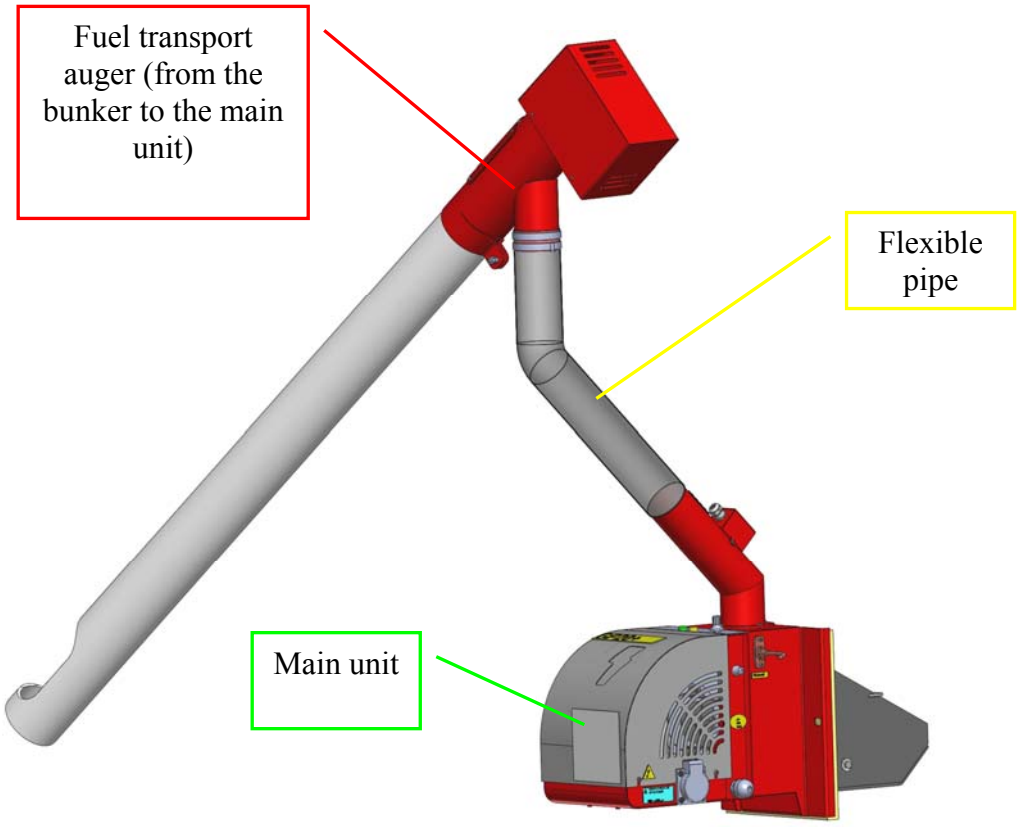

Figure 2.3. Arrangement of the modules of the pellet burner *(side view)*;

- **Preliminary information for the fuel hopper**

  The fuel hopper is the "reservoir" for the fuel of the pellet package, which ensures conditions for compact fuel storage of the required fuel, needed for nominal operation of the system for appropriate period of time and optimal operating conditions of the pellet transport auger, as well as the main unit of the burner. In case that the pellet hopper is designed onsite, then it's construction must allow easy and unobstructed fuel gravity driven transport of the wood pellets to the fuel extraction orifice of the hopper. The design of the hopper should consider easy fuel charging, easy access for wood fine particles cleaning and mainly appropriate capacity for prolonged and reliable pellet system operation.
  ERATO company is a producer of an prefabricated pellet hopper, which is designed to be assembled onsite. The hopper is produced from zinc coated steel plates. The capacity of the main module of the pellet hopper is 250kg, one or two (no more than two) additional sections could be attached and the overall fuel capacity will be 450kg and 650kg respectively;

Figure 2.4. Main module of the prefabricated metal pellet hopper (*the figure shows the main module with wood pellets capacity of 250kg*);

3. Technical data for the system, consisting of: hot water pellet boiler of series “MARIO” and a pellet burner of series “ERATO GP20+”.

- Thermal and technical data for the system: hot water pellet boiler of series “MARIO” and pellet burner of series “ERATO GP20+”, utilizing wood pellets are given in **Table 3.1;**

- Dimensions and technical data for the system: hot water pellet boiler of series “MARIO” and pellet burner of series “ERATO GP20+”, utilizing wood pellets are given in **Table 3.2;**

- Properties of the recommended fuel, which could be utilized on the pellet system, are described in the **user manual of the automatic pellet burner of series “ERATO GP20+”**;
- Classification of the wood pellets, according to their proximate analysis is shown are described in the **user manual of the automatic pellet burner of series “ERATO GP20+”**;

EXPLANATION : the hot water pellet boiler of series “MARIO” is produced in two versions – “**left side flanged**” for the attachment of the pellet burner and “**right side flanged**” (looking in front of the boiler).

Parameter	Dimension	Value	
Hot water pellet boiler model	-	**MARIO 25**	**MARIO 30**
Pellet burner model	-	**ERATO GP20+/25**	**ERATO GP20+**
Nominal thermal capacity	*kW*	*25*	*30*
Thermal capacity operation range	*kW*	*7.5 – 25*	*9 - 30*
Utilized fuel	• *Wood pellets;* • *Pre-dried cherry nuts;* • *Other dried nuts;*		
Utilized pellets, complying ERATO classification methodology	*A, AB, B*		
Wood pellets fuel consumption rate at nominal thermal capacity	*kg/h*	*6.0*	*7.2*
Fresh air flow rate, required for effective combustion process and boiler operation	*kg/h*	*45 - 50*	*57 - 64*
	m^3/h	*39 - 44*	*50 - 56*
Averaged wood pellets consumption rate (the boiler is operating in a popular heating system)	*kg/h*	*4.1*	*4.9*
Thermal efficiency at nominal capacity	*%*	*86 - 90*	*86 - 90*
Air excess ratio	λ	*1.5 – 1.7*	
Flue gasses temperature at nominal thermal capacity	*°C*	*180 – 200*	
Solid fuel residue	*ash*	*The quantity depends on the ash contents in the raw fuel, as well as operating conditions*	

Table 3.1 Thermal and technical data for the system: hot water pellet boiler of series "MARIO" and pellet burner of series "ERATO GP20+", utilizing wood pellets**.**

Parameter		Dimension	Value	
Hot water pellet boiler model		-	**MARIO 25**	**MARIO 30**
Pellet burner model		-	**ERATO GP20+/25**	**ERATO GP20+**
Weight of the boiler		*kg*	*180*	*190*
Weight of the system		*kg*	*212.2*	*222.2*
Boiler's water jacket capacity		*dm³*	*50*	*60*
Overall dimension of the system: (WxDxH)	**W**-*width*	*mm*	*1030*	*1030*
	D-*depth*		*770*	*770*
	H-*height*		*964*	*1045*
Class of the boiler (according to EN 303-5)		-	*3*	
Operating overpressure of the circulating water		*MPa*	*0.15*	
Heating system expansion vessel type		-	*opened*	
Factory tested overpressure		*MPa*	*0.4*	
Recommended circulating water temperature in the boiler		*°C*	*80*	
Minimal recommended return water temperature in the boiler		*°C*	*60*	
Draught		*hPa*	*0.1 - 0.2*	
Connections	*Supply/return flow*	*G*	*1½"*	
	Drainage	*G*	*½"*	
	Flue gases duct	*mm*	*149*	
Power supply		-	*L1, N, PE, 50Hz; 230V;*	
Electrical capacity		*VA*	*<100 + 1100 (at ignition)*	
Electric protection		-	*IP20*	

Table 3.2. Dimensions and technical data for the system: hot water pellet boiler of series "MARIO" and pellet burner of series "ERATO GP20+", utilizing wood pellets.

The next figures show the dimensions and the design of the modules of the system.

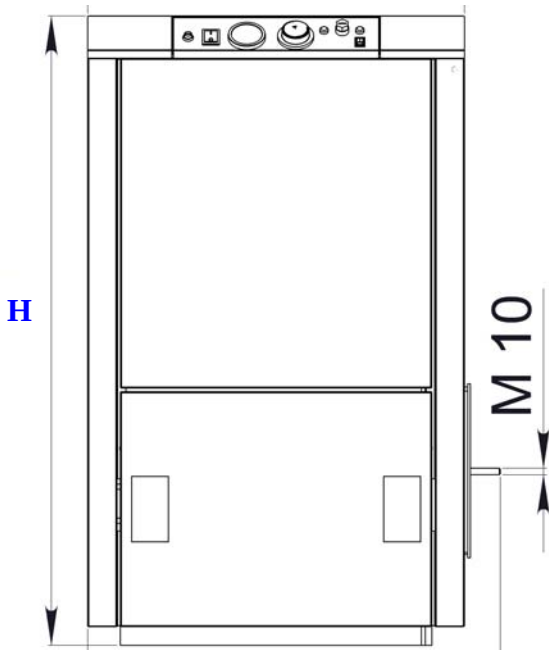

Figure 3.1. Front side view of the hot water pellet boiler of series "MARIO" (*the overall as well as the attachment dimensions are shown*) – *front side view*;

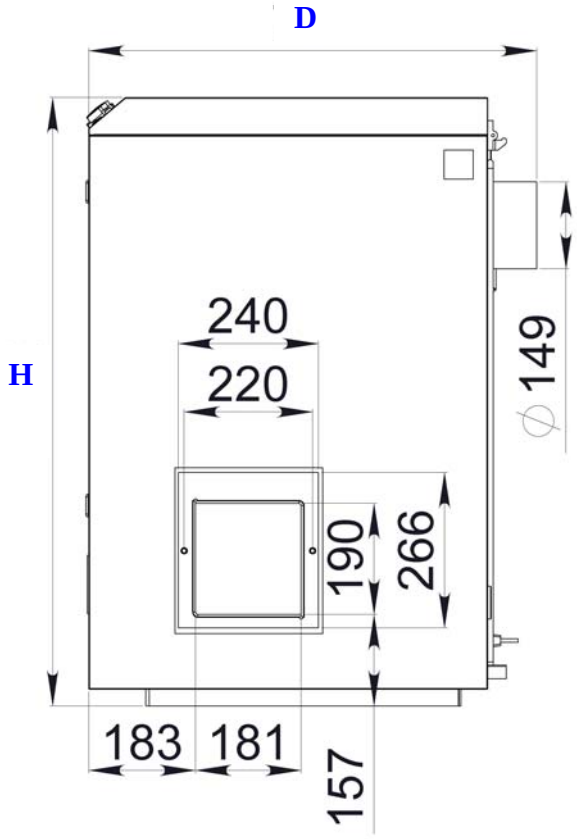

Figure 3.2. Side view of the boiler of series "MARIO" (*the overall as well as the attachment dimensions are shown*) – *burner flange side view*;

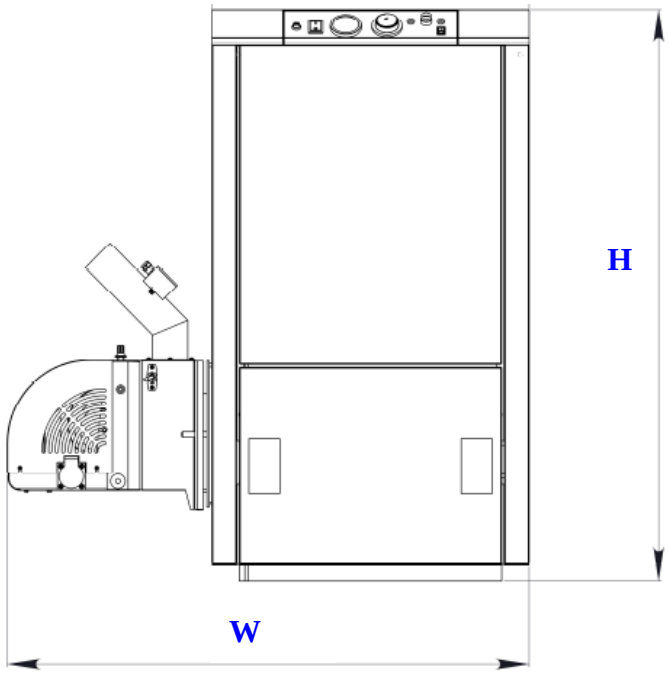

Figure 3.3. Front view of the system (*the overall dimensions are shown*) – hot water pellet boiler of series "MARIO" and a pellet burner of series "ERATO GP20+" (*left side burner attachment is shown*);

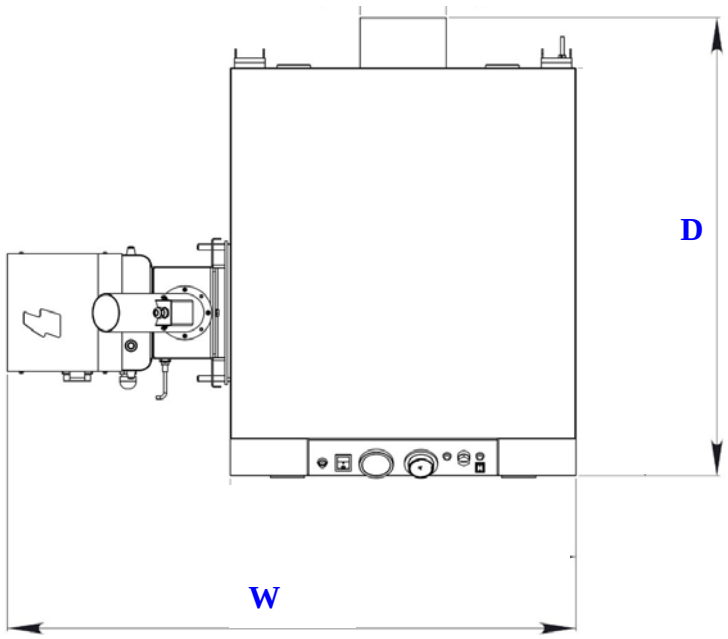

Figure 3.4 Top view of the system (*the overall as well as the attachment dimensions are shown*) – hot water pellet boiler of series "MARIO" and a pellet burner of series "ERATO GP20+" (*left side burner attachment is shown*);

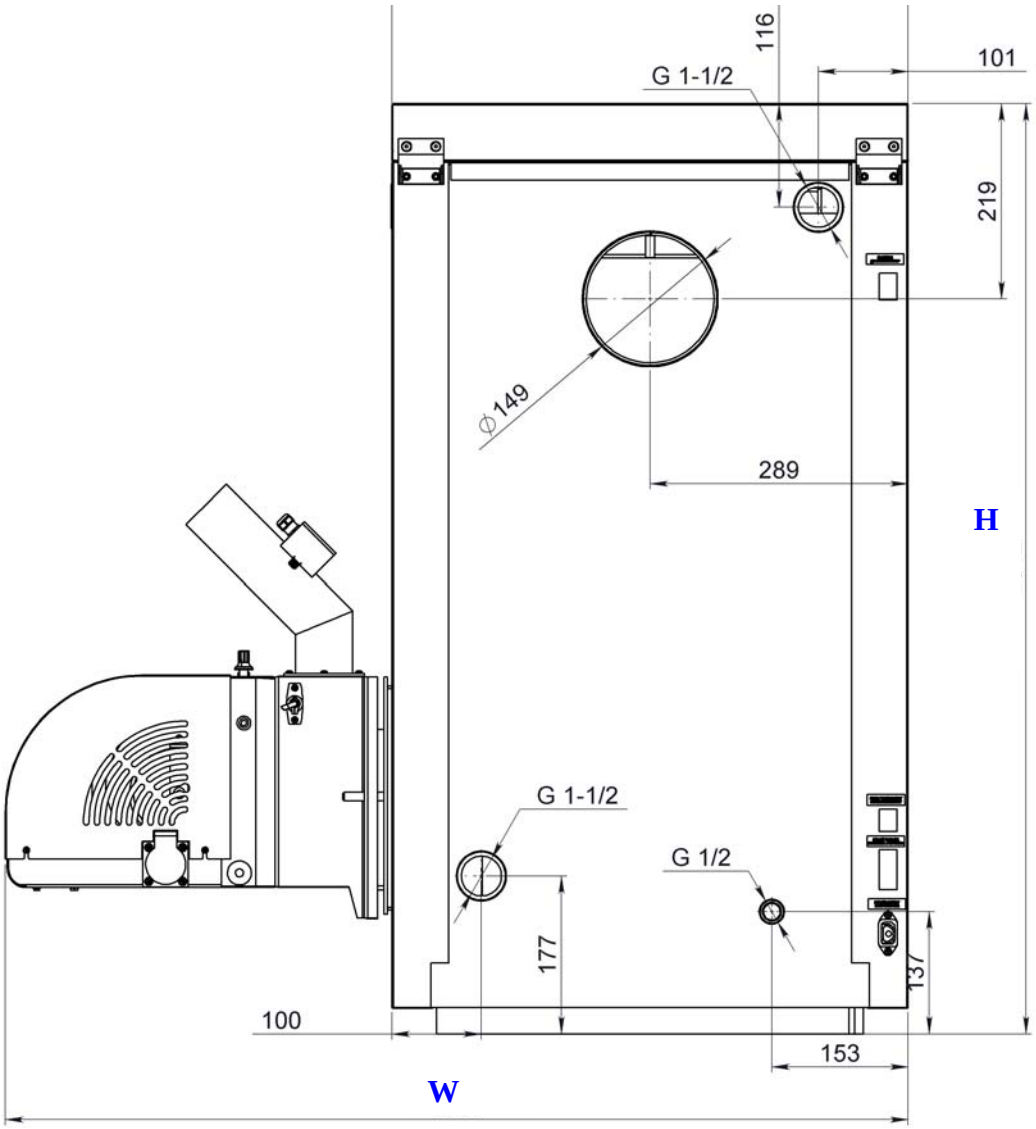

Figure 3.5. Back side view of the system (*the overall as well as the attachment dimensions are shown*) – hot water pellet boiler of series "MARIO" and a pellet burner of series "ERATO GP20+" (*right side burner attachment is shown*);

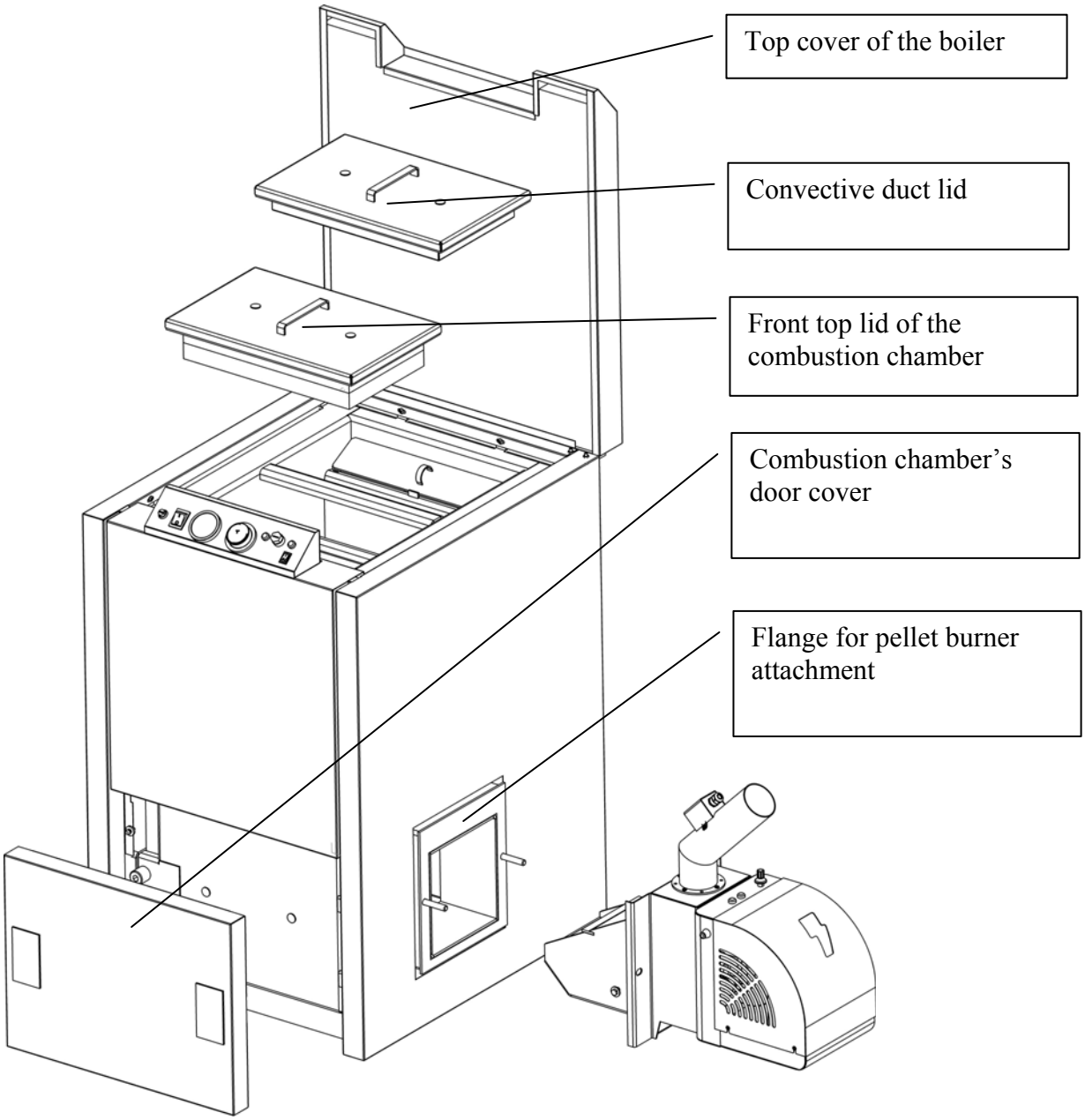
Top cover of the boiler
Convective duct lid
Front top lid of the combustion chamber
Combustion chamber's door cover
Flange for pellet burner attachment

Figure 3.6. Isometric view of the system – hot water pellet boiler of series "MARIO" and a pellet burner of series "ERATO GP20+" (*right side burner attachment is shown*);

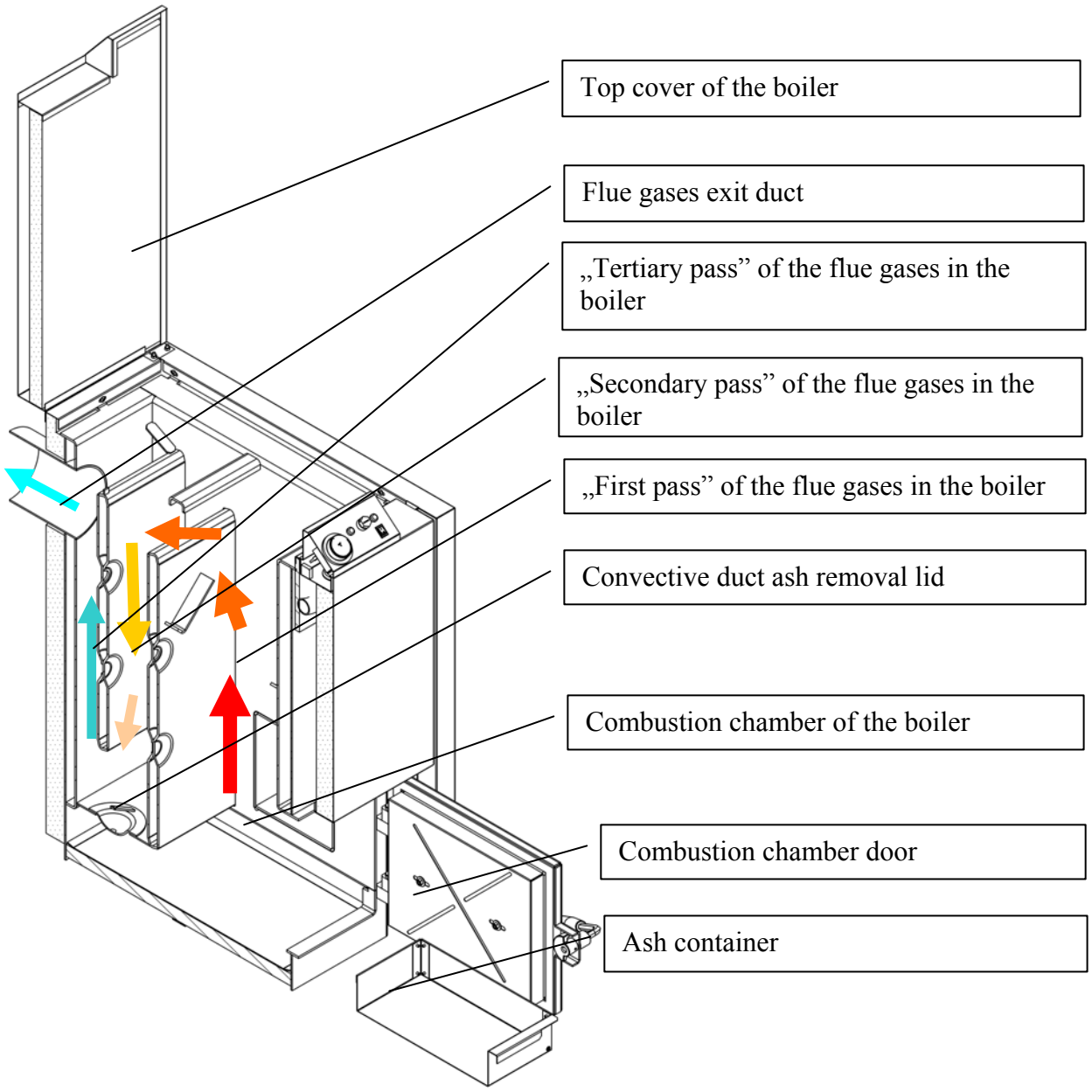
Top cover of the boiler
Flue gases exit duct
„Tertiary pass" of the flue gases in the boiler
„Secondary pass" of the flue gases in the boiler
„First pass" of the flue gases in the boiler
Convective duct ash removal lid
Combustion chamber of the boiler
Combustion chamber door
Ash container

Figure 3.7. Cross section of hot water pellet boiler of series "MARIO" *(the flue gasses pathway is schematically shown, the main elements of the heat exchanger are pointed, right side burner attachment is shown);*

4. Installation process of the system

4.1. Special features and requirements for assembly and installation of automatic pellet burner of series “ERATO GP20+” and hot water pellet boiler of series “MARIO”

The automatic pellet burner of series „ERATO GP20+” is attached and mounted on the heat exchanger of hot water pellet boiler of series “MARIO”. The design of the heat exchanger of hot water boiler of series “MARIO” allow only either “left” or “right” side installation of the burner (through an attachment flange), so the choice of the position of the pellet burner should be performed at the heating system project development. The installation of the burner should achieve reliable insulation between the burner and the boiler, so to prevent flue gases extraction out of the boiler’s combustion chamber out to the ambient environment, either ambient air penetration to the combustion chamber. The burner’s attachment and installation procedures should follow the requirements, depicted below:

- easy access for ash cleaning procedure of the burner’s grate;
- reliable and safe operation of the burner and system’s modules;
- possibility for adjustment and service procedures of the systems “ hot water boiler of series “MARIO” and the pellet burner of series “ERATO GP20+”– for burner’s operation adjustment, for fuel transport auger service procedures and maintenance, for loading the fuel hoper and maintenance, etc.;

4.2. Requirements for installation of system : hot water pellet boiler of series “MARIO” and pellet burner of series “ERATO GP20+”:

Preliminary notes : the achieved thermal capacity of the system : hot water pellet boiler of series “MARIO” and automatic pellet burner of series “ERATO GP20+” depends on:

- The thermal capacity of the pellet burner (i.e. its thermal capacity adjustment);
- The ash deposition on the heat exchanging surfaces of the boiler;
- The condition of the gasket between the burner and the heat exchanger, as well as the combustion chamber’s door gasket rope;
- Chimney’s draught;

The efficiency of the system : hot water pellet boiler of series "MARIO" and automatic pellet burner of series "ERATO GP20+" at nominal thermal capacity and nominal operating conditions will be in the range of 86 - 90% (depending the individual variation of each system) – *this is achieved through combustion process adjustment by utilizing gas-analyzer measurement (performed by trained technician)*;

4.3. Installation and attachment of the modules of the system : hot water pellet boiler of series "MARIO" and automatic pellet burner of series "ERATO GP20+"

Install the hot water pellet boiler, following the requirements and instructions, described below:

4.3.1. Basic requirements for installation of hot water pellet boiler of series "MARIO" :

- The room, dedicated to mount the system, should be supplied with fresh air supply duct, necessary for optimal combustion process as well as room ventilation;
- Installation of the system in inhabitable premises, including dwelling corridors, is not allowed;
- The hot water boiler should be connected to the heating system by authorized technicians only;
- Installation and service procedures of solid fuel hot water boiler as well as the pellet burner should be performed by authorized qualified and certified technician ONLY;
- The hot water pellet boiler of series " MARIO" should be connected ONLY to heating system, supplied with **OPENED** expansion vessel;
- Both the entire heating system and the hot water boiler should be totally filled with circulating fluid (water) and air-free before operating the boiler;
- Maintenance procedures of the modules of the system should be performed by trained adult persons, which have read the user manual of the unit;

4.3.2. Installation of the system

Installation procedure of the system : hot water boiler of series "MARIO" and the pellet burner of series "ERATO GP20+" requires development of engineering project for the heating system, prepared according to the acting local norms and recommendations as follows:

- To the heating system - EN 303-5/2000 - „*Heating boilers. Part 5 : Heating boilers for solid fuels, hand and automatically fired, nominal heat output of up to 300 kW. Terminology, requirements, testing and marking*";
- Local requirements for attachment to the chimney;
- Local requirements for fire prevention requirements;
- To the power circuit - EN 60335-1/1997- "*Household and similar electrical appliances – safety, Part 1 – General requirements*";

4.3.3. Installation of the hot water pellet boiler of series "MARIO", considering it's easy maintenance and servicing :

- The minimal space in front of the boiler for cleaning, maintenance etc, should be 1000 mm;
- The minimal distance allowed between the back side of the boiler and a wall should be 400 mm;
- The minimal distance from the boiler's side, where the pellet burner of series "ERATO GP20+" will be attached and a wall should be 500 mm, in order to allow easy maintenance and servicing procedures of the burner as well as the pellet hopper;

  COMMENTS: *the requirements for the installation of the fuel transport auger are given in the user manual of the automatic pellet burner of series "ERATO GP20+"*;
- The minimal distance between the opposite side (on the pellet burner's one) of the boiler and a wall should be 500 mm in order to ensure easy access to the heat exchanger and to allow easy cleaning of the deposited ash;
- The minimal distance between the top side of the boiler and a wall (ceiling) should be 600 mm, in order to ensure easy access for the cleaning and maintenance procedures of the heat exchanger (for example for ash cleaning);
- The minimal distance between the hot water boiler of series "MARIO" and the pellet hopper should be 1000mm in order to

ensure fire safe operating conditions and prevent and alarm modes;

4.3.4. Boiler's positioning according to the requirements for attachment to the electric power supply circuit

The system should be positioned and should allow easy access to the power supply plug box (230V/50Hz);

4.4. Procedure for installation of the modules of the system

After the hot water boiler of series "MARIO" has been positioned, it should be connected to the heating system as well as to the chimney, considering the appropriate requirements. In order to ensure safe and reliable operation of the boiler, it should be horizontally leveled, which will allow easy air relieving of the circulating water.

4.4.1. Connecting to the chimney

After the boiler has been positioned and leveled, it should be connected to the chimney, following the requirements for efficient and reliable operation of the system.

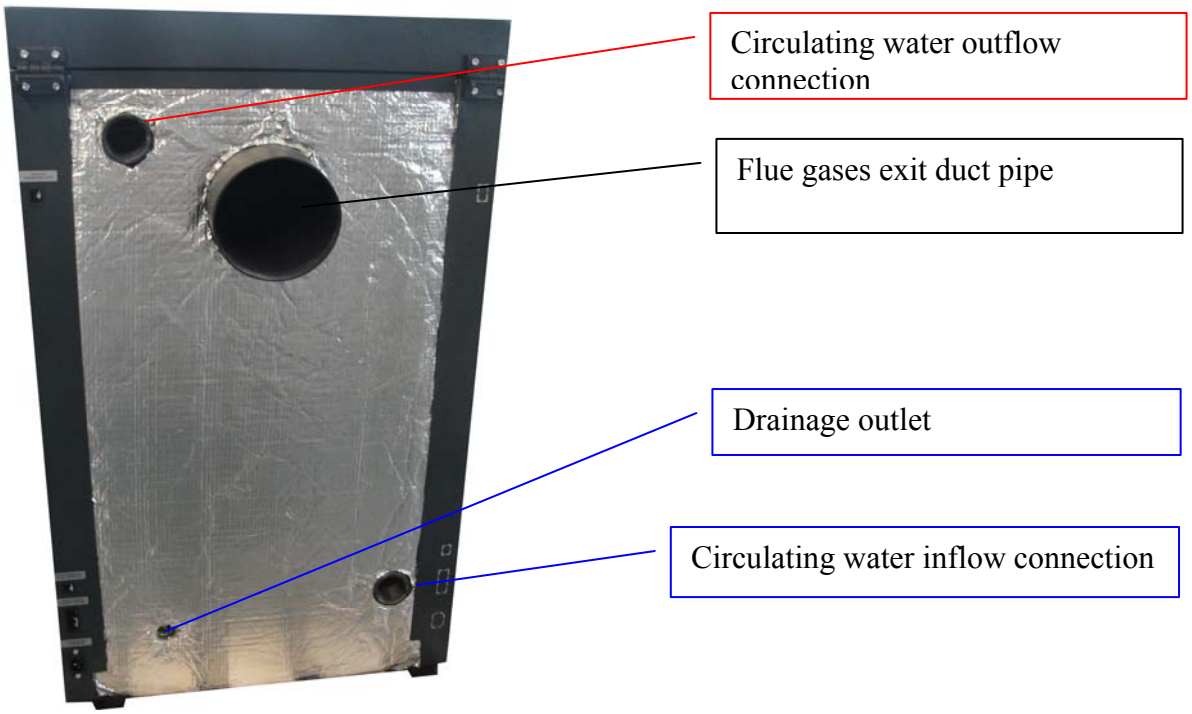

Figure 4.1. Backside view of the boiler of series "MARIO";

4.4.2. Connecting to the heating system

The boiler of series "MARIO" should connected to the heating system by appropriate fittings and other control elements – *it should be performed following the prepared project*.

4.4.3. Installation of the automatic pellet burner of series "ERATO GP20+"

EXPLANATION – at the installation of the automatic pellet burner of series "ERATO GP20+" it is necessary to follow strictly the requirements, depicted in the burner's user manual. Use the applied mineral wool insulation gasket, applied to the pellet burner. Please take care to prevent any gasket damages as the burner is attached to the flange of the boiler – this gasket both reduces the ambient air penetration into the combustion chamber as well as plays role of thermal insulation and thus reduces the heat flow rate back to the burner's main module.

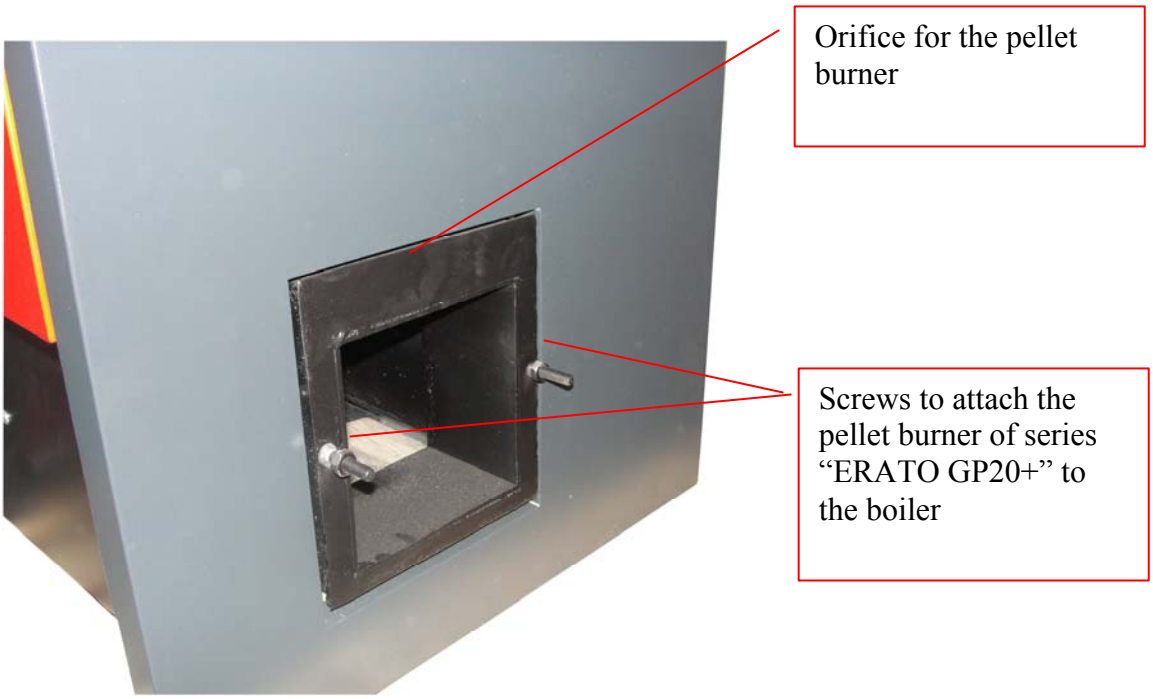

Figure 4.2. Side view of the orifice and the flange for attaching the pellet burner to the hot water boiler;

After the pellet burner has been mounted in the orifice of the boiler, the next step is to tighten the attachment nuts in order to ensure air tight assembly between the heat exchanger and the burner's attachment flange.

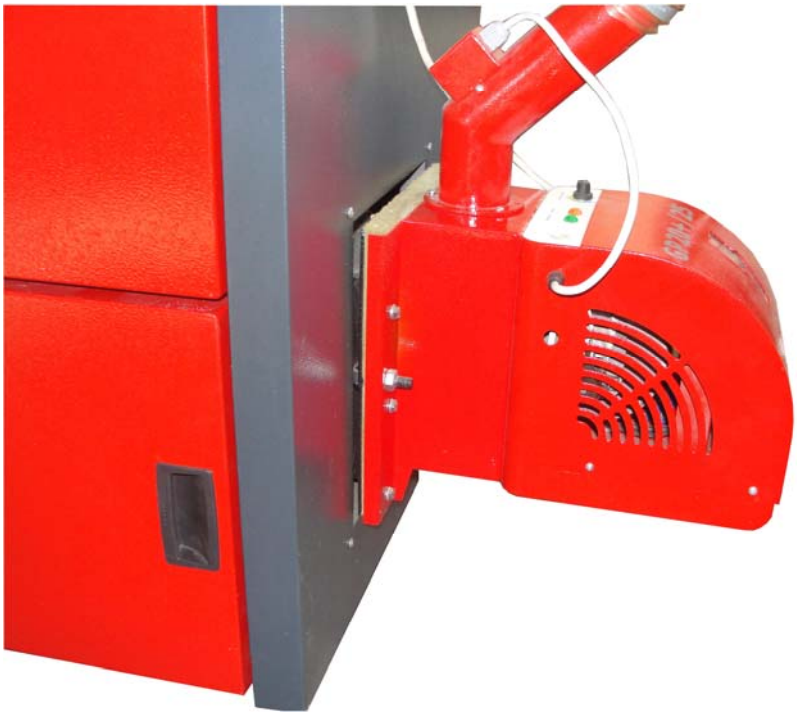

Figure 4.3. ИSide view of the pellet burner of series “ERATO GP20+”, installed on the boiler’s heat exchanger;

4.4.4. Installation of the two ceramic plates in the combustion chamber of the boiler

Install of the two ceramic plates in the combustion chamber of the boiler – they will direct and flue gases and will allow efficient combustion process (*these plates are packed and positioned in the at ash tray at the transport of the boiler*);

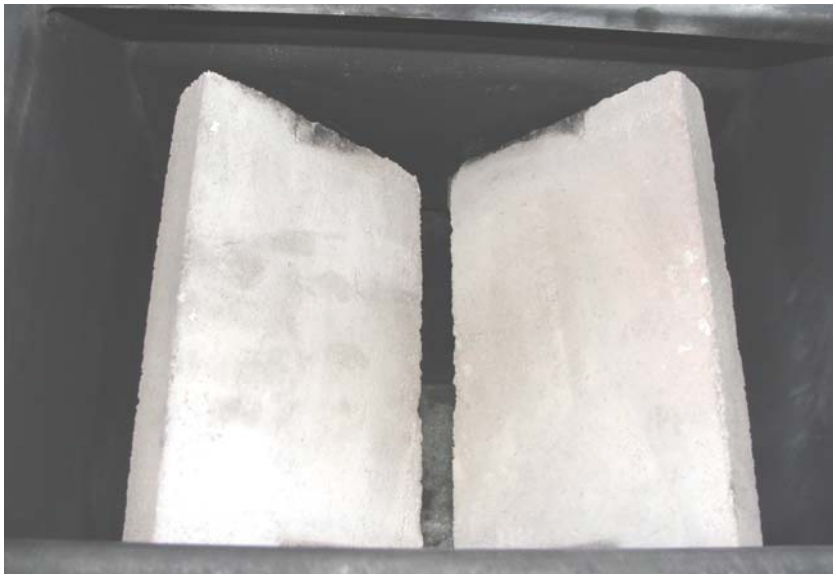

Figure 4.4. The ceramic elements are installed in the combustion chamber of the hot water boiler of series “MARIO” (they are positioned on specially welded supporting plates);

4.4.5. Install the secondary ash lid at the bottom of the convective part of the boiler;

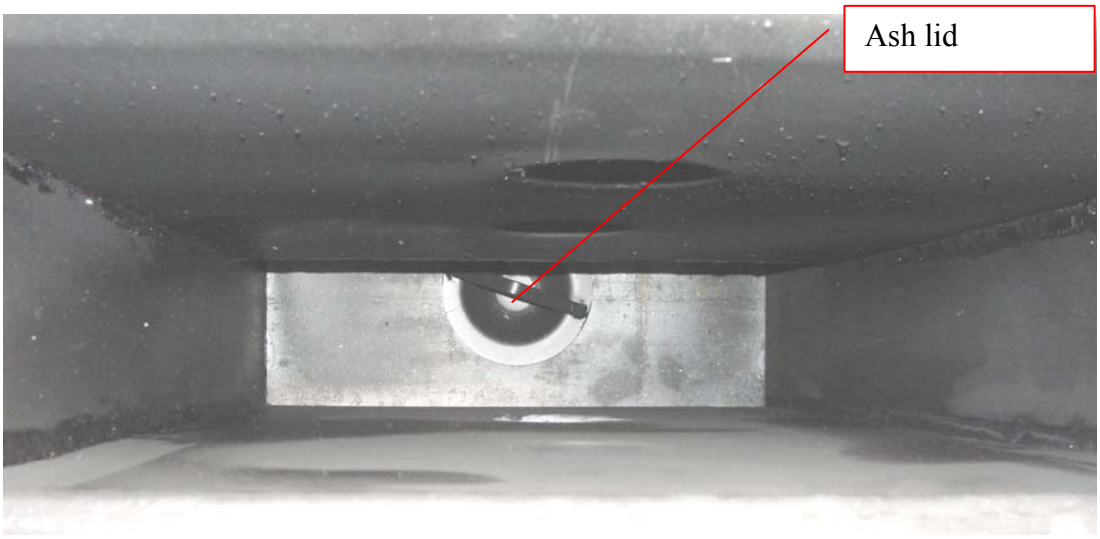

Figure 4.5. The ash lid (*which covers the orifice for ash cleaning between the secondary and tertiary flue gases duct of the heat exchanger*) is positioned;

EXPLANATION: *the correct installation of the ash lid is strongly required, as its correct position allows proper and efficient operation of the boiler. That' why after the boiler has been positioned and leveled, the position of the ash lid should be checked and verified, as well as each ash cleaning of the internal surfaces of the heat exchanger;*;

4.4.6. Installation of the flue gases duct lid

The flue gases duct lid should be positioned by supporting it's side to the specially welded supporting elements on the heat exchanger and supporting the other lid's side on the heat exchanger vertical wall.

EXPLANATION : this lid directs the flue gases from the secondary flue gases duct to the tertiary one, in case of alarm modes (for example at high pressure in the combustion chamber, due to fuel explosions) this lid open (due to pressure difference) and thus allow damage prevention and pressure pulse reduction

ATTENTION : this lid is thermally loaded, that's why it is symmetric. It is recommended to turn over this lid periodically (for example to turn it upside down on a period of two to three week operation of the boiler).

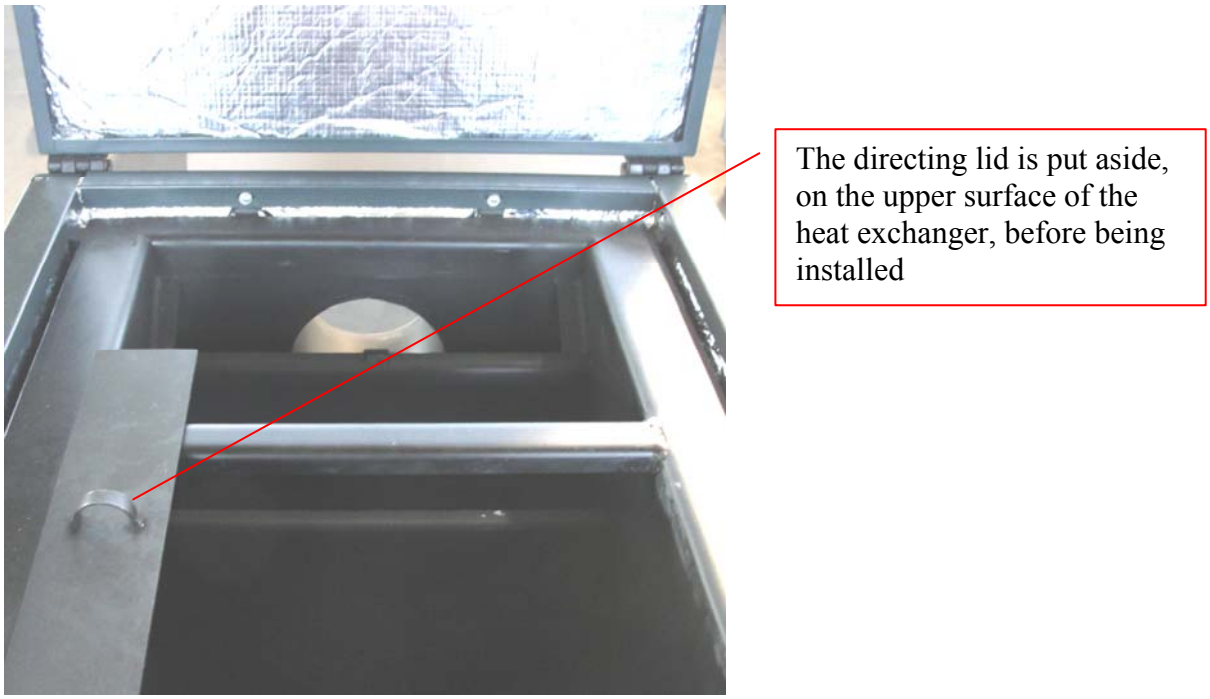

Figure 4.6. The flue gases lid is put aside and the flue gases exit duct of the boiler is seen;

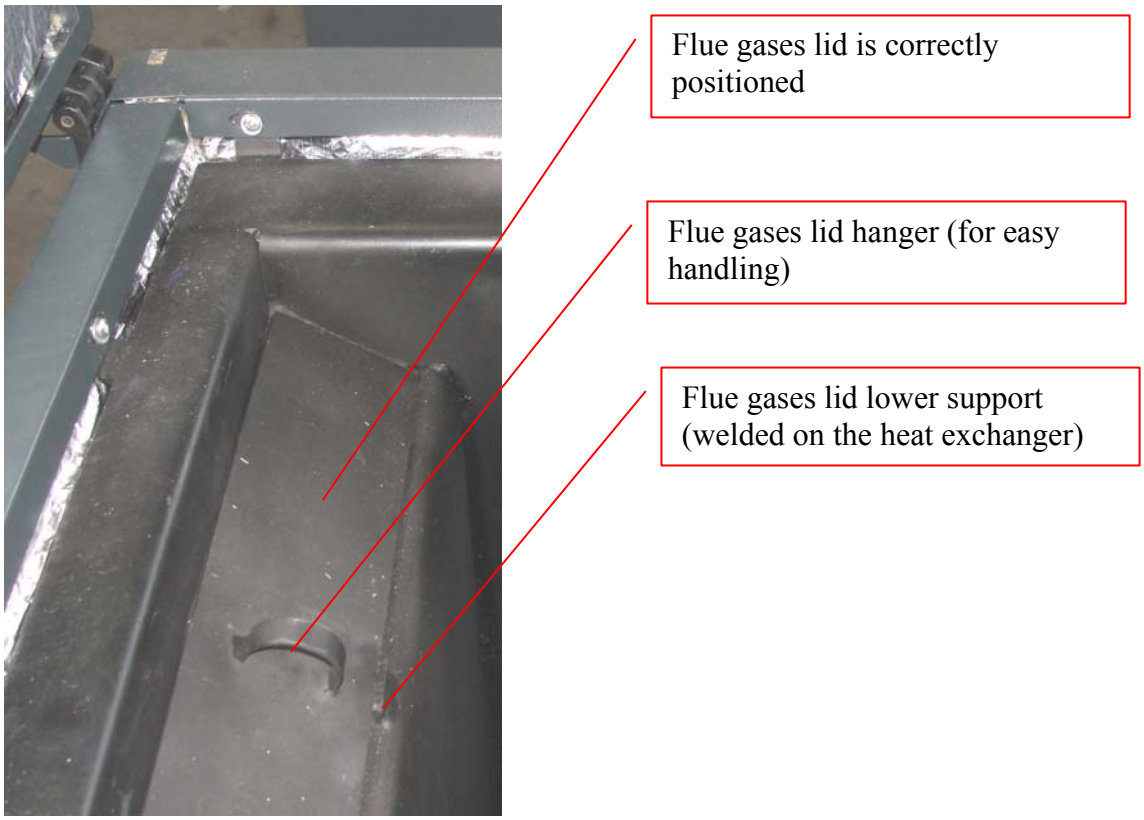
Flue gases lid is correctly positioned
Flue gases lid hanger (for easy handling)
Flue gases lid lower support (welded on the heat exchanger)

Figure 4.7. The directing lid correct position is shown;

4.4.7. Installation/verification of the horizontal combustion lids and the combustion chamber cover

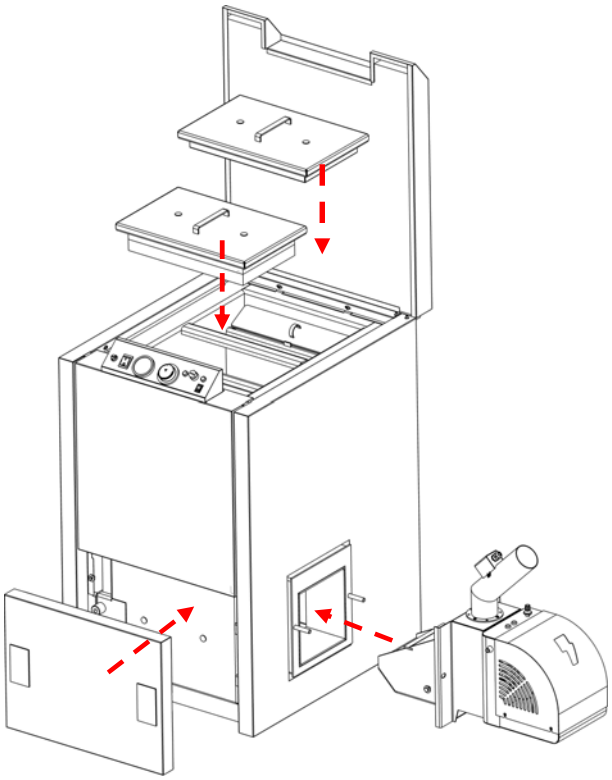

Figure 4.8. Positioning the cover elements of the hot water boiler of series “MARIO”

4.4.8. Install the heat exchanger’s convective duct lid

EXPLANATION : this lid has thermal insulation protection plate, produced from stainless steel.

Figure 4.9. The convective part lid is put at the place of its position;

4.4.9. Install the boiler's heat exchanger combustion chamber lid

EXPLANATION : this lid has thermal insulation protection plate, intended to operate at high temperature levels of the flue gases in the combustion chamber of the boiler.

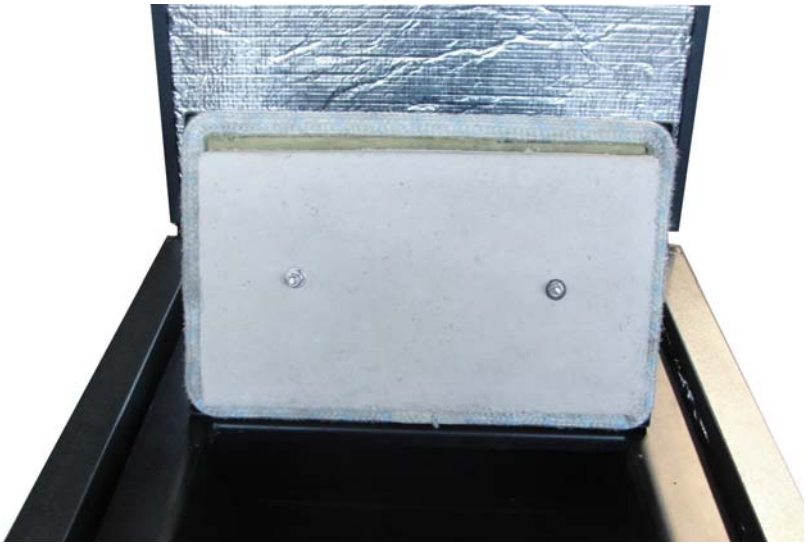

Figure 4.10. The combustion chamber lid is put at its position;

Figure 4.11. Both flue gases directing lids are positioned on their place of the hot water boiler's heat exchanger;

ATTENTION : these flue gases directing lids are not one and the same, do not change their position.

4.4.10. Connect the pellet burner of series “ERATO GP20+” to the hot water boiler of series “MARIO”

Connect the automatic pellet burner to the boiler by plugging burner’s connector to the boiler female connector.

On the back side of the hot water boiler are installed electrical connectors – these connectors are for the power supply of the boiler, for connecting the pellet burner, for connecting a room thermostat, for connecting a flue gas fan (this fan is an option, i.e. it is not a module of the system).

ATTENTION : these electrical connectors are equipped with an element, which prevents involuntarily detachment of the connectors – do not force them, use appropriate tool in order to unplug;

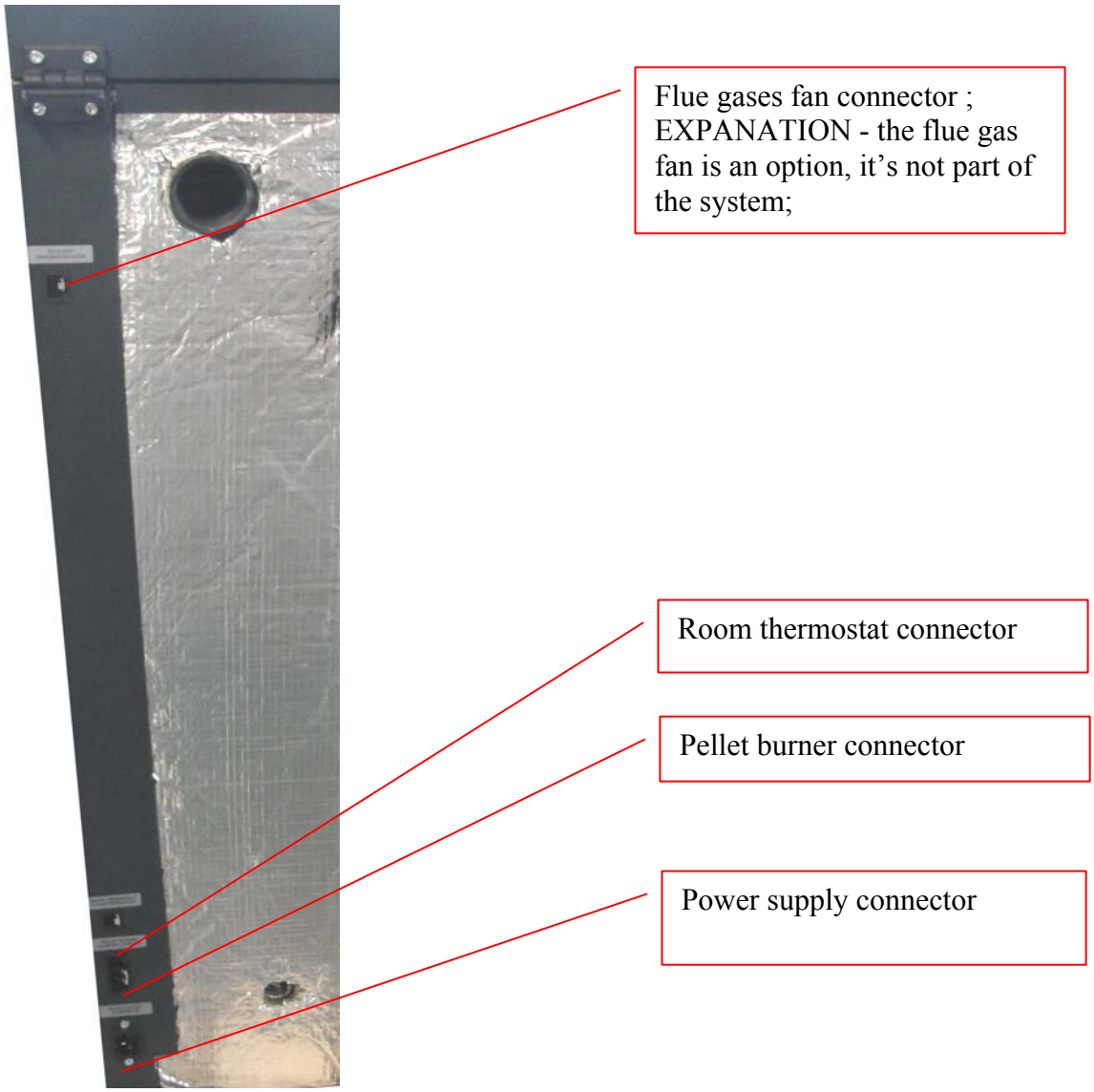
Flue gases fan connector ; EXPANATION - the flue gas fan is an option, it’s not part of the system;
Room thermostat connector
Pellet burner connector
Power supply connector

Figure 4.12. Back side view of the boiler – *the electrical connectors are labeled*;

4.4.11. Installation of the pellet transport auger

The process of pellet transport auger is described in the pellet burner's user manual.

At the installation of the pellet transport auger the requirements, which are described in details in the automatic pellet burner of series "ERATO GP20+" user manual should be followed;

EXPLANATION : *The angle (between the axis of the auger and horizontal plane) of inclination of the transport auger influences on its productivity, i.e. on the fuel flow rate, achieved at the local conditions on the systems installation. That's why at variation of the auger's inclination the burner could require adjustment of its operation mode.* ***The burner's adjustment is done by trained authorized technician only***;

4.4.12. Pellet transport auger fuel charging.

The transport auger of the pellet burner of series "ERATO GP20+" is initially empty (no fuel inside it's pipe). The power supply plug should be connected to power supply, thus the motor of the auger will operate constantly. Charge the pellet hopper and wait until the pellets start to drop out of the exit orifice of the auger, then unplug the power supply of the auger and connect it to the female plug of the pellet burner (positioned on burner's right side), then switch on the power supply of the pellet boiler of series "MARIO".

ERATO company reserves the right to make any changes of the design and factory setting of the burner as well as the hot water boiler, without obligation to inform about that the end users.

4.4.13. Connect the control box of the boiler to the power supply;

Use the applied connectors, connect the power supply cable to the boiler, then connect it to the main power supply chain. The connection should be performed by authorized technician only.

EXPLANATIONS :

- *The producer reserves the right to make changes of the desing of the modules of the system, without noticing the end user;*
- *At initial start-up of the pellet burner as well as when the contents of the pellet hoper is consumed, the auger must be filled-up with fuel. This fuel charging process is described in the automatic pellet burner's user*

manual. This operation should be explained and demonstrated on the end user by trained service technician;

4.4.14. Final view of the system

Figure 4.13. Final view of the system: hot water pellet boiler of series "MARIO" and a pellet burner of series "ERATO GP20+";

4.4.15. Recommended principal hydraulic scheme for the hot water pellet boiler

Recommended principal hydraulic scheme for connecting the hot water pellet boiler of series "MARIO" to a heating system, equipped with **OPENED** expansion vessel is shown on the following figure.

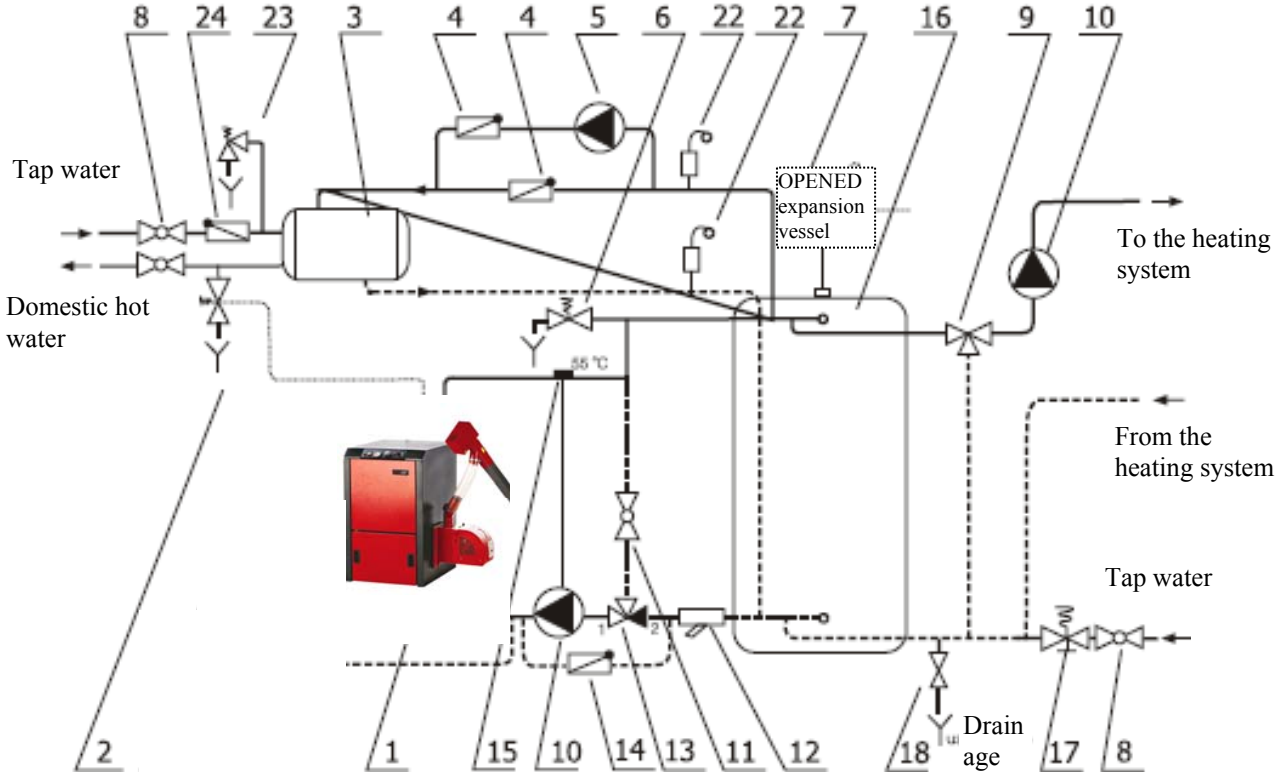

Figure 4.14. Recommended principal hydraulic scheme for connecting the hot water pellet boiler of series "MARIO" to a heating system, equipped with **OPENED** expansion vessel (obligatory), mixing valve and a heat accumulator.

Index	Designation
1	Hot water boiler "MARIO"
2	Safety valve
3	Hot water boiler
4	Return valve
5	Circulating pump 1
6	Control valve
7	Expansion vessel
8	Control valve
9	Three way mixing valve
10	Circulating pump 2
11	Control valve

Index	Designation
12	Water filter
13	Thermovalve TV
14	Return valve
15	Contact thermostat
16	Heat accumulator
17	Automatic circulating water charger
18	Drainage valve
22	Automatic air separator
23	Safety valve
24	Return valve

Table 4.1. Description of the elements, indexed on figure 4.14

EXPLANATION : *According to EN 303-5 the heat accumulator tank is obligatory module of a local heating system, operating with solid fuel hot water boiler. The heat accumulator capacity calculation is made according to the above mentioned norm, as well as heat accumulator methodology, developed by ERATO.*

ATTENTION: ***The finalization of the system installation and performing the commissioning tests should be filled in the appropriate documents of the boiler as well as the pellet burner, where the required data fields should be filled in (this is obligatory).***

5. System starting procedures.

ATTENTION: the system, consisting of " hot water pellet boiler of series "MARIO" and an automatic pellet burner of series "ERATO Gp20+" should be installed and commissioned by trained, authorized and certified company only.

5.1. Basic fuel requirements.

- The fuel, pellet shaped, should be dry. The unit producer recommends that the fuel should be stored in dry and well ventilated rooms;
- It is strongly forbidden to store the fuel in close region of the system (both the boiler and the burner), the minimal safety distance between the fuel and the appliance is 400 mm;
- The system producer recommends an optimal distance between the boiler and the fuel container to be at least 1000mm. It is recommended to store the fuel in room, next to that, where the boiler is installed;
- At the installation procedure of the system, as well as the fuel storage one, fire prevention recommendation should be considered. It is also recommended to install a fire-extinguisher in a safe and easy accessible place;

In principle heating systems, which are hydraulically **opened** to the atmosphere allow direct contact between the circulating fluid (in most cases it is water) and the air. During the heating season the water content in the expansion vessel absorbs oxygen from the atmosphere though the free surface. The increased oxygen content in the water threatens the metal of the unit, as well the pipes. Through the free surface of the expansion vessel water evaporation is observed as well. Considering these, appropriate water should be added through the expansion vessel – it must cover the requirements of norm BDS 15207-81.

During the heating season regular checking of circulating water level in the expansion vessel should be performed by the end user. The water content in the circulating system should be kept constant. If additional water is required, then precautions should be taken, not to add air in the heating system as well. The water, utilized for filling purposes of the heating system should be decontaminated and air-free, and is not dedicated for any other purposes, but as a circulating fluid only. Any heating system drainage is inadmissible, except when repairing modules/sections of the system. Practical experience shows that water level checkup should be performed regularly in a period of 14 days in order to sustain quasi-constant water content.

In case that additional water is required, the filling process should be performed carefully, when the hot water boiler is cooled to the ambient temperature. This precautions are induced due to prevent rising of thermal stress of the steel boiler's body and its damage (leakage).

In case that the boiler as well as the heating installation will not be in exploitation for a long period, then in order to prevent local water freezing and damages, it is advisable to perform total drainage of the circulating water. Please take into account that the presence of liquid in the heating system, as well in the boiler will prevent oxidation process of the metal surfaces, corrosion and system failures.

5.2. Starting up the system (consisting of hot water pellet boiler of series "MARIO" and automatic pellet burner of series „ERATO GP20+").

Basic requirements :

- Any maintenance procedures should be performed in accordance with the described in this manual;
- Any intervention in the working process of the system, which could lead to unit's failure and/or dangerous and health threatening situations, are strongly prohibited;
- The system should be checked by the maintenance staff or any trained personal regularly;
- The end-user should not perform any interventions, repairs, etc. of the system. In case that warning and failures arise, check the failures table (applied at the end of this manual) and call the service support if the case is not described there;
- Any adjustments of thermal capacity higher than the nominal thermal load of the modules are not allowed;
- The ash, deposited in the combustion chamber of the boiler, should be collected in fireproof containers and cooled down to ambient temperature. The cooled ash should be disposed in appropriate waste containers. Please take into account that the mineral ash, result of wood biomass pellets could be considered as soil fertilizer and dispersed for agricultural purposes for example;

5.2.1. Interface control board of hot water pellet boiler of series “MARIO”

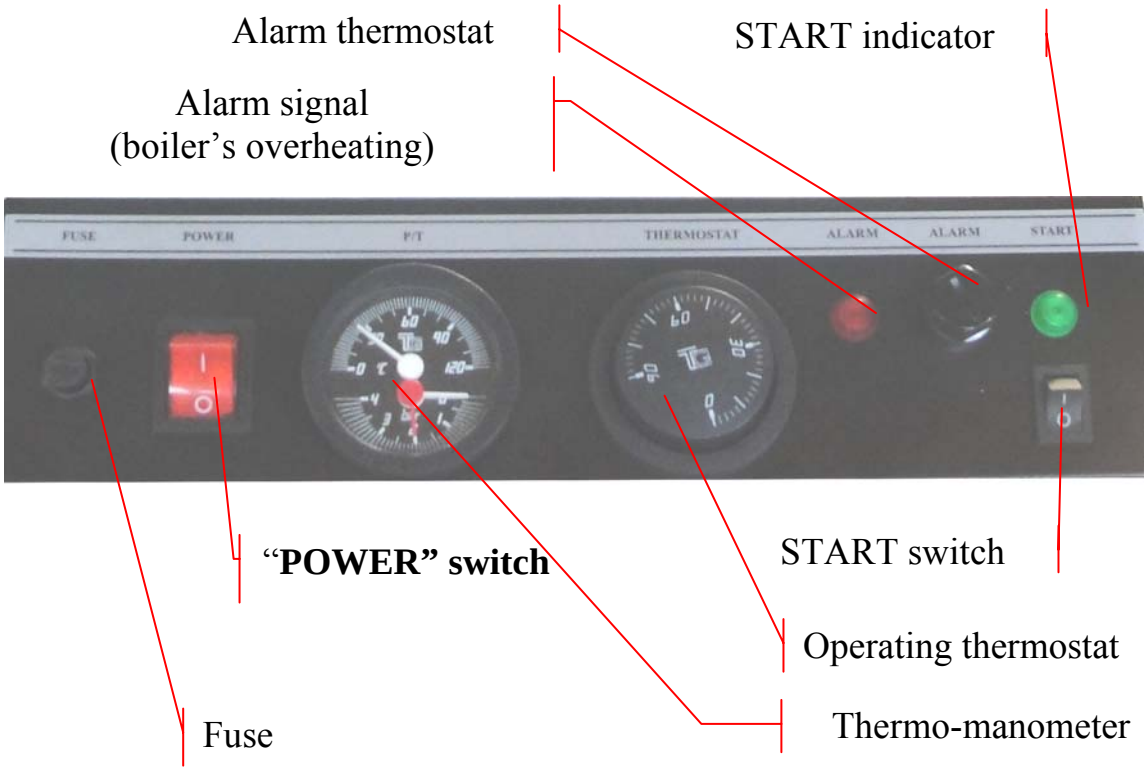

Figure 5.1. Interface control board, equipped with control and operating devices of hot water pellet boiler of series “MARIO”.

Interface control board devices description:

- Main “**POWER**” switch – *switches ON and OFF the main power supply of the hot water pellet boiler of series “MARIO” and the pellet burner of series “ERATO GP20+”*;
- **Operating thermostat** – *assigns the set-point of circulating water temperature in the boiler. The pellet burner of series “ERATO GP20+” (i.e. the system) will run until this set-point is reached and will supply heat energy to the heating system*;
- **Emergency thermostat** – *protects the hot water boiler of series “MARIO” from exceeding emergency temperature levels and overheating. This thermostat is factory preset to switch off the power supply of the pellet burner of series “ERATO GP20+” at water temperature in the boiler above 95°C (factory set)*;
- “**START**” switch – *sends “START/STOP” signal to the process control module of the pellet burner of series “ERATO Gp20+”, which controls its operation;*
- **Thermo-manometer** – *indicates the operating temperature of the circulating water in the heat exchanger jacket of the boiler, well as water overpressure;*

- **Alarm indicator – emergency boiler overheating** – *indicates emergency overheating state of the boiler, due to activation of the emergency thermostat of the boiler. In case of activation, cool down the unit and check and repair the reason for the emergency situation, finally reset the emergency thermostat*;
- **"START" indicator** – *indicator lamp, light up at presence of operating signal for the pellet burner of series "ERATO GP20+"*;
- **Fuse –** *main electrical power fuse of the boiler*;

5.2.2. Hot water boiler of series "MARIO" power supply.

- The unit should be connected to the main power supply, according to the safety rules and appropriate norms. The system includes a power supply cable – use this to connect the boiler;

5.2.3. System very first start

The pellet hopper (*which is not an element of the system: pellet boiler of series "MARIO" and pellet burner of series "ERATO GP20+"*) should be filled with pellets, in order transport material by the pellet feeding auger to the burner.

Read the user manual of the pellet burner of series "ERATO GP20+" first.

The system is switched on by the main "POWER" supply switch, placed on the control board of the pellet boiler. The system gets activation signal by switching ON the "START" and goes into automatic operating mode – it goes through ignition mode if needed. If the "START" switch is OFF then the burner goes (or stays) into stand-by mode and waits until new command arise. In case of power supply break-down the burner will go into the same state of the unit before the interruption. The "START" signal for the pellet burner is given by the operating thermostat of the boiler (in case that room thermostat is installed, then this thermostat should set "START" mode as well).

ATTENTION :

- *It is possible to observe flue gases emission out of the boiler at starting up the system, especially in case that the chimney does not have appropriate draught (for example lack of chimney's height or the chimney's flue duct is clogged. The above mentioned gases could be released through the door gasket or the upper section of*

the boiler, where the flue gases lids are positioned – check and verify their position. It is recommended to check the condition of the chimney as well. The same process could be observed during the transition periods (during spring and autumn), when the natural draught of the chimney is not covering the loses in the flue duct of the system, due to the high levels of the ambient temperature;

- *It is possible due to incorrect adjustment of the initial doze of the fuel to observe smoke extraction out of the boiler, due to uptightness of the gaskets of the hot water boiler. In case of this situation it is necessary to make adjustment of the operating parameters of the burner – this procedure is performed by authorized, trained and certified technician only;*

EXPLANATIONS:

- *In ignition mode, the electric heater is activated (i.e. switched on) – this heater is mounted under the inclined plate in the combustion chamber of the burner. This electric element heat up the fuel until the pellets are ignited and combustion process is stabilized. The photo-sensor of the burner senses the presence of light from the flame. Additional information about the ignition process is described in the pellet burner's user manual;*
- *The automatic pellet burner of series "ERATO GP20+" operates by predefined algorithm, which is implemented through specialized control board of the burner. The adjustment of the operating parameters of the control board of the burner is performed by authorized, trained and certified technician only;*

5.2.4. Operating parameters of the boiler.

The operating mode of the hot water boiler of series "MARIO" is defined directly by setting its operating thermostat set-point. However, one should consider that the inflow circulating water temperature influences the operating mode of the system, reflecting on its reliability and efficiency.

ATTENTION: *The producer guaranties effective and reliable operation of the system : hot water pellet boiler of series "MARIO" and a pellet burner of series "ERATO GP20+" only when the operating mode is in the range of the parameters, described in Table 3.2 of this user manual.*

5.2.5. Operating parameters for adjustment of the pellet burner of series "ERATO GP20+"

In the user manual of the pellet burner "ERATO GP20+" are given the adjustable parameters of the burner, which determine the operating mode of the burner, as well as the burner's thermal capacity. The user accessible parameters (the P2 parameter, the fuel, etc.) should be explained to the end user by the installer, thus giving opportunity to control the burner according to the client's heat demands and comfort requirements.

EXPLANATION: *It is recommended to make any changes of the operating parameters of the burner ONLY when the influence of this parameters on the overall performance of the burner's operation are know in advance. It is recommended to make any changes of the operating parameters by trained technician.*

COMMENTS:

- In the user manual of the automatic pellet burner of series "ERATO GP20+" are shown the operating parameters, which define the thermal capacity of the boiler, as well as the adjustment procedure;
- The user manual of the pellet burner contains information about the default values, the adjustment and the influence of the operating parameters of the unit – *their variation and adjustment should be performed by trained authorized technician only*;
- The producer reserves the right to make any changes of the factory settings of the burner, without any obligations to inform the end users;
- The adjustment of the thermal capacity of the system: hot water pellet boiler if series "MARIO" and pellet burner of series "ERATO GP20+" could be realized by determination of the fuel flow rate (i.e. to measure the mass of the pellets, transported for defined period of time), considering the calocific value of the fuel and the thermal efficiency of the system. Detailed description of such procedure could be found in the user manual of the pellet burner;
- During the nominal operation mode of the burner, alarm or abnormal situations could rise – i.e. unsuccessful fuel ignition, to run out of pellets, etc. The pellet burner will go into alarm mode and will indicate its status through appropriate indication of its LEDs. In case of such situation, the burner should be restarted – this is performed by swithching off the power supply and then back on, only after the alarm mode issue has been clarified and removed;

NOTES :

- In principal the fuel's ash content does not change its low calorific value. However, the combustion process is greatly influenced by the presence of

mineral mass, i.e. ash, but requires specially designed burner in order to achieve efficient and reliable operation. The above mentioned requires appropriate testing and verification of the fuel's applicability as energy source for the pellet burner of series "ERATO GP20+" before making nominal exploitation of the unit. Consult the requirement for fuel of the burner or the appliance producer's assistance;

5.2.6. Nominal operating mode of the system.

After the initial start-up of the automatic pellet burner of series "ERATO GP20+" (i.e. the fuel is successfully ignited) and the boiler has reached its nominal thermal conditions, the circulating water and the entire heating system are in steady state thermal conditions (i.e. they are tempered, which takes time), it could be considered that the system is in nominal operation mode. The adjustment of the operating (both the boiler's as well as the pellet burner's) parameters should be performed. Detailed description of the pellet burner adjustment is given in its user manual.

At nominal operation of the system the commissioning of the burner's and boiler's operation should be performed, following the governing local requirements.

NOTES:

- The temperature of the return flow of the circulating water of a heating system is recommended to be above 60^{o}C, because of possibility to achieve condensation of the water vapor on the internal surfaces of the boiler;
- It is recommended to operate the boiler's thermal capacity in the range, described in Table 3.1. In case that lower thermal capacity are needed, this modes are much less efficient and heat accumulator is recommended to be attached to the system (see 4.4.15), in order to ensure reliable and efficient operation of the system;
- At the initial start-up of the pellet boiler of series "MARIO" intensive water vapor condensation could be observed. This is a single process and does not influence the performance of the system, neither causing any operating issues;
-

5.3. Control of the thermal capacity of the system.

The control of the thermal capacity of the system is performed by adjustment of the thermal capacity of the pellet burner of series "ERATO GP20+". *For detailed information about this process, please refer to the user manual of the pellet burner*.

ATTENTION : *In case of change of the fuel type (for example changing the pellets category, supplier, size, etc.) it should be followed by adjustment of the thermal capacity parameters and the operating mode of the burner.*

5.3.1. Decreasing the thermal capacity of the system:

It is realized by turning the thermal capacity potentiometer (on the control board of the pellet burner) **anticlockwise**. *For more information – refer to the pellet burner user manual*;

ATTENTION: *do NOT decrease the thermal capacity of the burner below the minimal one for the system, as such operating modes strongly decrease the thermal efficiency of system and lead to its low reliability;*

5.3.2. Increasing the thermal capacity of the system:

It is realized by turning the thermal capacity potentiometer (on the control board of the pellet burner) **clockwise**. *For more information – refer to the pellet burner user manual*;

ATTENTION: *do NOT increase the thermal capacity of the burner above the nominal one for the system, as such operating modes strongly increase the thermal loads of some of the components of the system, which could lead to alarm situations and eventually thermal deformations of parts of the combustion chamber of the pellet burner, the reliability of the system is decreased as well;*

5.4. Adjustment of the combustion process.

The adjustment of the combustion process of the pellet burner is described in details in the pellet burner's user manual. The combustion process adjustment should cover the requirements for the flue gases parameters of norm EN 303-5, as well as the requirements for nominal, safe and reliable operation of the system.

5.5. Stopping the operation of the system.

Stopping the operation of the system should be performed by turning OFF the "START" switch, mounted on the interface panel of the hot water boiler of series "MARIO". Respectively, the starting process will be invoked by turning "START" switch in ON position. In case that the system will not operate for a relatively short period of time, than it is recommended to clean the ash deposited on the easy accessed heating surfaces of the heat exchanger, as well as the combustion chamber's walls of the pellet burner.

EXPLANATION: *the stopping operation mode of the pellet burner of series "ERATO GP20+" is described in details in the burner's user manual;*

ATTENTION : *In case that the system will not operate for a long period of time, then the hot water boiler's heat exchanger should be thoroughly cleaned from the deposited ash. The deposited on the metal surfaces ash acts corrosively on the carbon steel surfaces, which will lead to a decrease of the lifetime of the systems main modules – heat exchanger of the boiler as well as the burner. It is obligatory to perform service procedures and preventive observations of the systems by trained service personal only as well as thorough cleaning at the end of each heating season. Completing these requirements will ensure long exploitation duration of the system and its high efficiency and reliability.*

5.6. Turning OFF the system.

The system (i.e. pellet boiler of series "MARIO" and pellet burner of series "ERATO GP20+") is turned **off** by changing the "START" switch of the boiler into OFF position - this is the recommended method for turning the system off. During the working process in OFF state, the control board of the pellet burner performs so called "controlled turning off procedure" in which the operating fan is working and certain operating system parameters are controlled. After the boiler has cooled down to ambient temperature, the system should be switched off by turning off the boiler's main "POWER" switch. It is recommended to clean the deposited ash thoroughly of the heat exchanging surfaces of the boiler.

- **Emergency stop of the system.**

  In operating process of the system emergency situations could arise and the component (i.e. the boiler and the pellet burner) will go into alarm/failure mode. Some situations are detected by the safety units and the process control board and the systems will go into automatic preventive regimes in order to protect the boiler and the heating system. These regimes are operated by appropriate automatic preventive measures as well as the control board indicates alarm mode, through its LEDs. Please refer to the pellet burner user manual, as well as this document before taking any

actions. After the cause of the alarm situation is clarified, take adequate actions for bringing back the system into normal operating conditions and restart the burner by switching OFF and back into ON state by turning the main "POWER" switch of the pellet boiler of series "MARIO".

ATTENTION :

- *in case of emergency situation – boiler overheating, the emergency thermostat is activated and the alarm indicator lamp is lit. In this case the boiler should be cooled down and the reason for such excessive process should be investigated and preventive measures should be performed. The emergency thermostat should be manually reset by unscrewing its preventive cap and its stem should be pressed until the thermostat switches back on (a "click" sound is heard in this process), screw the cap back. After the boiler is checked and the cause for overheating is determined and repaired, restart the pellet burner by turning off the boiler's the main "POWER" switch and then back on in order to operate the system in normal state*;
- *in case that the pellet burner of series "ERATO GP20+" has reached alarm mode, it will stop and go into alarm mode, which is indicated with the LEDs on its control board. Please refer the pellet burner's user manual for description of the alarm mode and take preventive actions;*
- *in case that the alarm mode is neither described in this documemnt or the pellet burner's user manual, then it is strongly recommenced to contact the system's servicing company in order to resolve the issue and start the nominal operation of the system;*

5.7. Showing and teaching the end user about the maintenance and adjustment procedures.

It is necessary to read thoroughly this user manual as well as the user manual of the pellet burner of series "ERATO GP20+", as well as the basic properties of the modules of the system. It is necessary to know the operation process of the boiler as well as the burner – i.e. starting, running, switching off, cleaning the ash, etc.

It is necessary to show and teach the end user the maintenance procedures for operating the boiler efficiently and keep its reliability in high degree order. Also the installer should demonstrate and teach the end user how to change the operative parameters of the control module of the boiler in order to operate the

unit in different modes and heat capacities, according to the local heat consumption:

- **Fuel hopper charging** – the fuel is poured out in the hopper of the system. The pellet auger takes out the fuel from the hoper and transport the fuel to the main module of the pellet burner;
- **Ash cleaning procedure** – it is recommended periodically (at least once per every 72 hours of system's operation) to stop the pellet burner by switching off the "START" switch of the control board of the boiler, wait until the system cools down (at least 30 minutes) and clean the ash residue of the heat exchanger of the hot water pellet boiler of series "MARIO" by manually scrapping and brushing the ash. Take away the ash residue, collected in the ash tray of the boiler if necessary. Covering this requirement will ensure effective heat exchanging process and will sustain optimal operating conditions of the boiler. Switch the boiler ON by turning on the "START" switch and the systems will start (if there is signal for operation);

  ATTENTION : *regular cleaning of the ash residue, deposited on the heat exchanging surfaces of the boiler will ensure long-life reliable exploitation period, economic and efficient performance of the unit;*

- **pellet burner grate ash cleaning procedure** – after the system has been switched off and the burner is cooled down to ambient temperature level, it is necessary to open the door of the boiler's combustion chamber, take away the grate of the burner, clean the ash residue, put the burner's grate back, then close the door and switch on the "START" and start the system;

  EXPLANATION : *the door of the pellet boiler's combustion chamber is closed by a handle. It is recommended not to apply high force at the closing process in order to protect the door's gasket heat resistant rope and to ensure combustion chamber's tightness. The opening of the door is performed by turning the handle clockwise (the handle's lever should be lifted upwards);*

Figure 5.2. Scrapping the ash residue off the walls of the pellet boiler of series “MARIO” heat exchanger;

Figure 5.3. Taking the ash tray out of the combustion chamber and cleaning the ash;

Open the combustion chamber’s door and take out the ash tray, positioned on the bottom of the boiler, the ash residue is collected there. Pour the ash residue in heat resistant container (or any appropriate container), put the ash tray back on its position, close the door, check the position and tightness of the upper lid on the heat exchanger as well;

ATTENTION : *regular cleaning of the ash residue, deposited on the heat exchanging surfaces of the boiler will ensure long-life reliable exploitation period, economic and efficient performance of the unit;*

5.8. Safety and unexpected risks

Risks could arise at the exploitation of the system:

The modules of the system– hot water pellet boiler of series “MARIO” and automatic pellet burner of series “ERATO GP20+” are designed and produced according to the safety requirements of the operating European standards and norms. However safety and unexpected risks could arise in situations like following:

- *Hot water pellet boiler of series “MARIO” is operating incorrectly;*
- *Automatic pellet burner of series “ERATO GP20+” is operating incorrectly;*
- *The system is installed by unauthorized/unqualified personal;*
- *The safety instructions, described in this manual are not followed and fulfilled;*

- *The safety instructions, described in the user manual of the pellet burner of series "ERATO GP20+" are not followed and fulfilled;*

Unexpected risks :

The modules of the system (pellet boiler of series "MARIO" and pellet burner of series "ERATO GP20+") are designed and produced according to the requirements of the operating EU safety norms. However, in spite of that possible risks are considered as a result of the operating process of the modules, it is possible to arise risks as follows :

- ***Cauterization risks**, caused by high temperatures, as a result of the combustion process in the combustion chamber and/or direct access to the front door of the combustion chamber, at manual cleaning processes of the surfaces of the burner and/or combustion chamber, or ash residue cleaning, accumulated in the ash tray or any unburned fuel material, smoldering in the ash tray;*

- ***Electrical shock risks** at indirect contact. The pellet boiler and the pellet burner are connected to the power circuit and their operating modules are separated in specialized electric control box, equipped with required protective and short-circuit preventive devices. It is obligatory to perform boiler ground connection by authorized personal/technician;*

- ***Fingers injuring risks** at opening/closing the doors/caps of the boiler at maintenance and cleaning process of the unit. It is recommended to use appropriate individual resources for self-protection;*
- ***Suffocation risks** due to flue gas uncontrolled emissions in the boiler's room, in case when the chimney draught is insufficient, in case that the convective part of the boiler is clogged, or in case that the flue gas duct is not fully tightened and gas leaks are possible;*

5.9. Operation faults and their repairing

In case of system failure, it is necessary to clarify the issues and find appropriate solution. Some of the operating faults are described in the pellet burner's ("ERATO GP20+") user manual and appropriate solution is proposed. This document contains additional information, which will be helpful both for the end user as well as the technicians.

No	Operation fault	Cause	Method for repairing
1.	Low temperatures	Insufficient thermal	Adjustment of operating

	in the heat supplied rooms	capacity	parameters of the burner is required – *check the burner's user manual*;
		Low set-point temperature of the boiler's operating thermostat	It is necessary to increase the set-point of the boiler's operating thermostat (up to 90^{o}C)
		Low set-point temperature of the remote room thermostat (if connected)	It is necessary to increase the set-point of the room thermostat
2.	High temperatures in the heat supplied rooms	High set-point temperature of the boiler's operating thermostat	It is necessary to decrease the set-point of the boiler's operating thermostat (it is recommended to keep it above 60^{o}C)
		High set-point temperature of the remote room thermostat (if connected)	It is necessary to decrease the set-point of the room thermostat
3.	The boiler is active, but no combustion process	"START" signal is not present	It is necessary to check the status of the operation signal of the pellet burner - *check the room thermostat, "START" switch, boiler's operating thermostat.*
4.	Difficult fuel ignition	Low quality fuel	It is necessary to replace the fuel, most probably due to its high moisture content, which could be above the required value for nominal operation of the burner.
5.	Boiler's emergency overheating	Absence of heat consumption or incorrect adjustment of the parameters of the boiler or poor operation of the heating installation	It is necessary to check the correct operation process of the heating installation and eventually appropriate adjustment of the operating parameters of the pellet burner and/or control valves of the installation – *this should be performed by authorized technician*.

			After the boiler is cooled down to ambient temperature and the reason for boiler overheating is serviced out, the protective cap of the emergency overheating thermostat should be unscrewed, its rod should be pressed until the thermostat is reset and it's cap should be screwed back. The main "POWER" switch is turned OFF and back ON afterwards and the system is thus restarted.
6.	No fuel ignition	Absence of fuel in the hopper	The fuel hopper should be charged
		Absence of fuel in the burner	It is possible to manually restart the operation process of the burner. Check if the ignition process needs to be elongated - *the adjustment should be performed by authorized technician only*;
		Fuel is present in the burner, but it's not ignited or it is fully incinerated and the combustion process has extinguished;	In case that the electrical heater is out of order or not operating, then it should be renewed. In case that the heater is working, then it is necessary to increase the time for ignition of the initial mass of the fuel - *the adjustment should be performed by authorized technician only*;

		Abnormal operation or malfunctioning of the burner's photocell	The burner's photocell should be checked or replaced – *see the pellet burner's user manual*;
	The flame looks "opaque" and smoke is observed at the exit of the chimney	Low quality pellets	Fuel replacement is recommended, most probably the moisture content is higher than required;
		Inappropriate operating parameters adjustment of the pellet burner	It is necessary to perform adjustment of the operating parameters of the pellet burner and achieve efficient combustion process - *the adjustment should be performed by authorized technician*;
7.	Presence of unburned fuel in the ash tray of the boiler	Ineffective fuel combustion process	It is necessary to perform adjustment of the operating parameters of the burner – *the adjustment should be performed by authorized technician*;
8.	High temperature of the flue gases (if flue gas thermometer is mounted)	The heat exchanging surfaces of the boiler are deposited with ash, presenting heat resistive layer, thus decreasing the heat exchanging intensity	It is necessary to clean thoroughly the heat exchanger surfaces of the hot water pellet boiler of series "MARIO";
9.	Water vapor condensates on the surfaces of the heat exchanger	Low temperature of the inlet water flow	Check the adjustment of the heating system. It is necessary to perform adjustment of set-point temperature, which controls the circulating pump of the heating system. It is recommended to adjust the thermostat set-point to minimum of 65^{o}C;
10.	Flue gases are	The gaskets of the lids, the	It is necessary to check

	emitted out in the boiler's room after certain period of exploitation	combustion chamber gasket, eventually the gasket between the pellet burner and the boiler are out of order and need replacement	and tget tightened the gaskets, or their replacement – *this procedure should be performed by authorized technician*;
11.	Pellet burner combustion chamber's thermal deformation	Overheating of the pellet burner	It is necessary to change the operating parameters of the pellet burner or eventually replace it;
12.	Other failures, not described above		It is necessary to consult authorized technician and eventually service maintenance should be performed

Table 5.1. Description of operation faults of the system (consisting of hot water pellet boiler of series "MARIO" and automatic pellet burner of series "ERATO GP20+"), causes and methods for repairing

5.10. Pellet system warranty form completion.

The applied WARRANTY FORM should be completed, by filling the required information in the appropriate fields. The assigned field for signatures and stamp should be completed as well in order to <u>VALIDATE</u> the WARRANY FORMS of the hot water pellet boiler of series "MARIO" and the one for the pellet burner of series "ERATO GP20+".

COMMENT : ***the automatic pellet burner of series "ERATO GP20+" has its own warranty form, which should be fulfilled as well;***

5.11. Actions, after the modules of the system are not in exploitation anymore.

After the lifetime period of the modules of the system have been completed, then they should be treated properly in order to preserve environment contamination. The units should be dismounted and disassembled

by environmentally safe methods. This requirement is most commonly completed by appropriate components recycling, considering separate waste disposal and utilization methods.

6. Electrical scheme of hot water pellet boiler of series "MARIO".

Figure 6.1. shows the principal electrical scheme of the control board of the pellet boiler of series „MARIO".

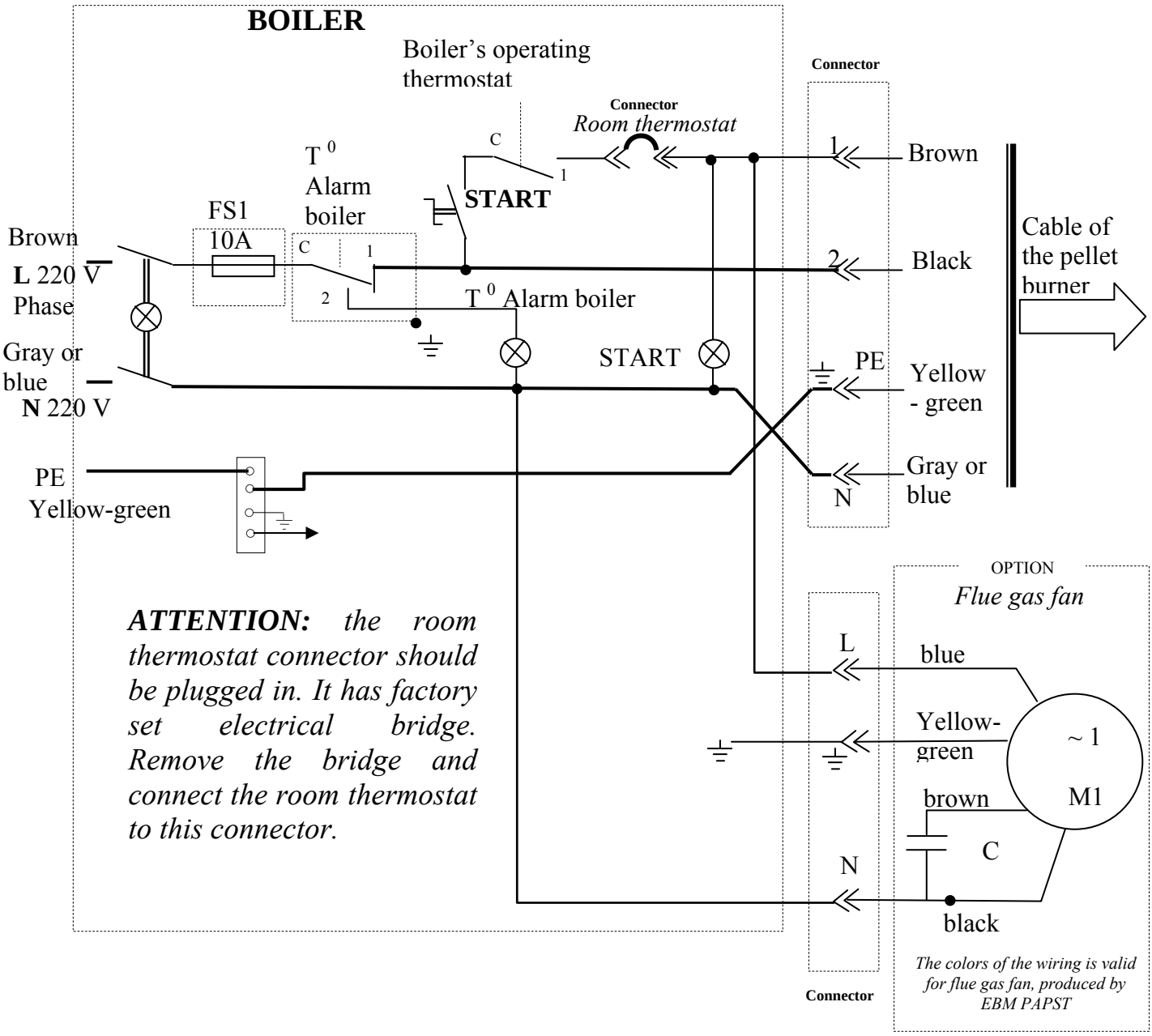

Figure 6.1. Principal electrical scheme of the control board of the pellet boiler of series „MARIO";

EXPLANATION: *the principal electrical scheme of the automatic pellet burner of series "ERATO GP20+" is shown in its user manual.*